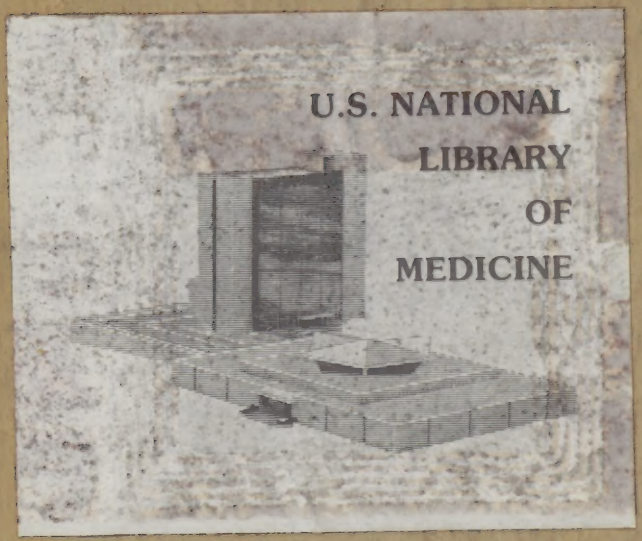
REPORTS ON THE AFTER EFFECTS OF WARFARE GASES

By

Lieut. Col. H. L. Gilchrist, M.C., U.S.A.

WAR DEPARTMENT
CHEMICAL WARFARE
MEDICAL DIVISION
WASHINGTON, D.C.



WAR DEPARTMENT

U. S. CHEMICAL WARFARE SERVICE, U. S. A.

MUNITIONS BUILDING

WASHINGTON, D. C.

MAY 5 1922

reply refer to

From: Chief, Medical Division, Chemical Warfare Service.

To: Chief, Chemical Warfare Service.

Subject: Report on the After Effects of Warfare Gases.

1. I am submitting herewith the following report pertaining to the after effects of warfare gases on the human organism.

2. This report embraces all obtainable information on this subject both in this country and Europe.

3. Definite conclusions concerning the after effects of gases on latent diseases and their ability to produce permanent disability, can only be learned by the continued research and by the collection of clinical and pathological data over a long period of time by members of the Medical Profession.

4. There is no doubt but that those who were severely gassed are open to the various sequelae which may follow any of the acute respiratory diseases, but from information at hand, it is far from convincing that warfare gases are responsible for the large number of ailments attributed to them.

H. L. GILCHRIST,
Lt. Colonel, Chemical Warfare Service,
Chief, Medical Division,
Chemical Warfare Service.

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By

Lt. Colonel H.L. Gilchrist, Medical Corps, U.S.A.,
Chief, Medical Division, Chemical Warfare Service.

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The introduction of poison gases by the Germans at Ypres in April, 1915, marked a new era in modern warfare, and from a medical point of view introduced a large and almost new field of pathology of which, prior to this time, little was known, excepting through the rare occurrence of laboratory and industrial accidents.

The lack of information on a subject of such great importance was realized at the very beginning, and as a result, medical men and physicists all over the world began immediate investigations and ere long the published work concerning the subject became voluminous, comprising hundreds of titles.

Unfortunately, however, at the cessation of hostilities, the majority of these writers ceased their activities, dropping everything in their hasty endeavor to again take up the duties of peace time occupations. As a result, the curtain was lowered just at a time when the interesting and important medical phase of the war drama was being presented. On this account, little has been written concerning the most important phase of the subject, - namely; the Remote Effects of Gassing.

The object of this report, therefore, is to take up the reins where they were dropped three years ago. The reasons for this are becoming more and more obvious each day, especially considering the vast numbers of ex-soldiers and others complaining of conditions attributed to the after effects of this weapon of warfare.

The material published in this report is the result of over one year's investigation, during which time every means was adopted to obtain all available information on the subject both in this country and in Europe.

Before beginning this work, however, numerous conferences were held with medical officers of the Army, and Reserve Corps, who were familiar with gas warfare and its after effects; also with medical officers of the Navy, the Public Health Service, and others conversant with the subject. As a result the work was undertaken along the following lines:

1. To obtain all information on the subject from the reports, publications, etc., on file in the offices of the different government services.

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The object of this report, therefore, is to take up the matter where they were dropped three years ago. The reasons for this are because there are more gassing each day, especially considering the vast numbers of ex-soldiers and others contemplating of conditions attributed to the after effects of this weapon of warfare.

The material published in this report is the result of over one year's investigation, during which time every means was adopted to obtain all available information on the subject both in this country and in Europe.

Before beginning this work, however, conferences were held with medical officers of the Army and Navy Corps, who were familiar with gas warfare and its after effects; also with medical officers of the Navy, the Public Health Service, and other concerned with the subject. As a result the work was undertaken along the following lines:

1. To obtain all information on the subject from the reports, publications, etc., on file in the offices of the different government service

2. To obtain such information as possible from the medical services of our Allies.

3. To obtain the opinion of Commanding Officers of Government and other hospitals where ex-soldiers are being treated.

4. To obtain opinions from the leading medical men of this country and Europe concerning the subject.

5. To ascertain from manufacturing chemists of the country, whose employees had been intimately associated with gases similar to those used in war, and who at times had become affected with the same, their views on the subject.

6. To obtain all information from the Germans and Austrians along these lines.

7. To conduct laboratory examinations.

8. To examine the records of ex-soldiers filed with the Veterans' Bureau, suffering from conditions attributed to warfare gases.

In conducting this investigation, many difficulties were encountered. As already stated, medical literature, both domestic and foreign, relative to the subject, was rather negative. As a result, it was necessary to begin at the bottom. The few reports examined were also quite unreliable. As a rule, they were incomplete and lacked many essential details; generalization without statistical study seemed to be accepted and inferences drawn from them.

In order to comprehend the subject intelligently, it will be necessary to know something about the early effects of warfare gases, the weapons producing them, the classification of gases, and their importance from a military point of view. This subject is so large that no attempt will be made to go into detail, but in its treatment, brief reference will be made to the past, and evidence taken from the war itself.

Mention will be made of personal observations taken when in command of a large British Hospital where thousands of gassed cases were treated, and also as the Medical Director of the Chemical Warfare Service in Europe throughout the war, during which time thousands of gas casualties were seen, not only in our own hospitals, but those of our Allies.

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3. To obtain the opinion of Commanding Officers, Government and other hospitals where ex-soldiers are being treated.

4. To obtain opinions from the leading medical men of this country and Europe concerning the subject.

5. To ascertain from ex-soldiers, domiciled in the country, those employers who had been initially associated with gas-poisoning in those used in war, and the extent to which they became affected with the gas, their views on the subject.

6. To obtain all information from the Dominion and Australia along the lines.

7. To conduct laboratory experiments.

8. To examine the records of ex-soldiers dealt with the Veterans' Bureau, suffering from conditions attributed to mustard gas.

In conducting this investigation, many difficulties were encountered. As already stated, medical literature, both German and foreign, relative to the subject, was rather meagre. As a result, it was necessary to begin at the bottom. Our reports were also quite unavailable. As a rule, they were incomplete and lacked many essential details; consequently without a statistical study seemed to be inadvisable and inferences drawn from them.

In order to comprehend the subject intelligently, it was necessary to know something about the early effects of mustard gas, the weapons producing them, the classification of gases, and their importance from a military point of view. This subject is so large that no attempt will be made to go into details, but in the treatment, brief reference will be made to the most outstanding lessons from the war itself.

Mention will be made of personal observations taken when in command of a large British hospital where thousands of gassed cases were treated, and also as the Medical Director of the Chemical Warfare Service in Europe throughout the war, during which time thousands of gas casualties were seen, not only in our own hospitals, but those of our Allies.

The lessons gained from these experiences have been taken into consideration in arriving at certain findings in connection with this report.

GAS CASUALTIES DURING THE WAR.

The subject of gas casualties, how they were produced, and their comparison with casualties attributed to other means of warfare, will now be considered.

As is well known, our troops did not suffer from cloud gas attacks. The casualties, therefore, were due to projector bombs and artillery shell.

The first gas attack of importance launched by the enemy against American troops, occurred on March 21, 1918, when portions of the 42nd Division, occupying the Bouquet Rouge Sector, near Luneville, were severely gassed. There were many casualties. From that time up to the signing of the Armistice, our troops were subjected, more or less, to gas attacks, and few Divisions which participated in the great conflict, escaped.

As a result of this method of warfare, nearly one-third of all the casualties occurring in the American Army were attributed to gas warfare, which, when compared with the casualties produced by other means of warfare, is indeed startling.

According to the latest and most reliable information obtainable concerning this subject, there were, exclusive of the Marines, 260,783 battle casualties during the war. Of these, 2491, or approximately one per cent, were due to aerial bombs and high explosives; 263 to bayonets; 12 to saber; 70,552, or about 28 per cent, were due to warfare gases of all kinds; 51,226, or 20 per cent, were due to shell and shrapnel; 882 to hand grenades; 94,545, or 36 per cent, to gunshot wounds, all kinds; 3148 to falling bodies, and 36,694 were attributed to causes not specified.

Of the above casualties, 47,940 died. Of this number, 34,049 died on the field of battle from war weapons, other than gas, and 200 from gas, 12,470 died in hospitals from wounds other than those caused by gas, and 1221 from the effects of gas, or following infections.

To better present this matter for consideration, a series of charts have been prepared, which express in figures and graphic waves the important features connected with the subject.

Chart No. 1, not only shows the number of casualties admitted to the hospitals from wounds produced by the different weapons, but also the number of days lost from each kind of weapon, together with percentages for each, all being expressed graphically.

CHART NO. 1

CHART SHOWING NUMBER OF CASUALTIES ADMITTED TO HOSPITALS FROM WOUNDS PRODUCED BY THE DIFFERENT WAR WEAPONS, NUMBER OF DAYS LOST FROM EACH KIND, TOGETHER WITH THE PERCENTAGES OF EACH EXPRESSED GRAPHICALLY.

CHART DOES NOT INCLUDE THE CASUALTIES OF THE MARINE CORPS.

agents used.	No. caslts.	days lost.	%	10 20 30 40 50 60 70 80 90
Aerial bombing and explosions	2491	60241	1. .3	
Bayonets.	238	9984		
Sabers.	12	1577		
Gasses all kinds.	70552	[illegible]	30. 17.	
Shell and shrapnel	51828	[illegible]	20. 31.	
Hand grenades	887	[illegible]	.4	
Gunshot wounds	85545	[illegible]	36. 43.8	
Falling bodies.	2124	7155		
All others.	36594	[illegible]	14.1 1.7	
Grand Total	260763	1749144		

Chart No. 2 shows the kinds of gases responsible for producing these conditions.

CHART EXPRESSING GRAPHICALLY THE NUMBER OF CASUALTIES PRODUCED WITH THE DIFFERENT VARIETIES OF GASES USED BY THE ENEMY AGAINST THE UNITED STATES FORCES DURING THE WAR.
EXCLUSIVE OF THE DEAD ON BATTLE FIELDS AND CASUALTIES OF THE MARINE CORPS.

GASES.	NO. CASUAL'S.	EXPRESSED GRAPHICALLY PERCENTAGE 10 20 30 40 50 60 70 80 90 100
Poisonous Kind unknown	33587	
[illegible]	[illegible]	
Mustard Gas	27711	
Phosgene	6834	
[illegible]	[illegible]	
TOTAL	78852	

Chart No. 3 expresses graphically the number of gas casualties occurring in our forces during the war, together with the months during which they took place.

GRAPHIC CHART SHOWING NUMBER OF GAS CASUALTIES OCCURRING IN THE FORCES OF THE UNITED STATES IN FRANCE DURING THE WORLD WAR.

MONTH	NUMBER CASUAL'TS	EXPRESSED GRAPHICALLY PERCENTAGE 10 20 30 40 50 60 70 80 90 100
JANUARY	0.	
FEBRUARY	[illegible]	
MARCH	535.	
APRIL	656.	
MAY	[illegible]	
JUNE	6310.	
JULY	[illegible]	
[illegible]	[illegible]	
SEPTEMBER	[illegible]	
OCTOBER	[illegible]	
NOVEMBER	3667.	
UNCLASSIFIED	451.	
TOTAL	[illegible]	

EXCLUSIVE DEAD BATTLE FIELDS AND CASUALTIES OF MARINE CORPS.

Chart No. 4 expresses graphically, the number of casualties occurring in each Division participating in the war.

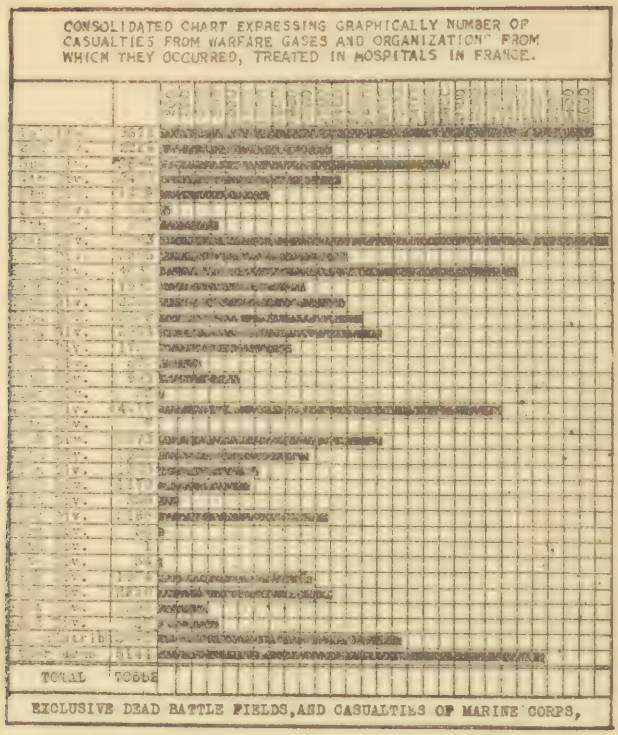
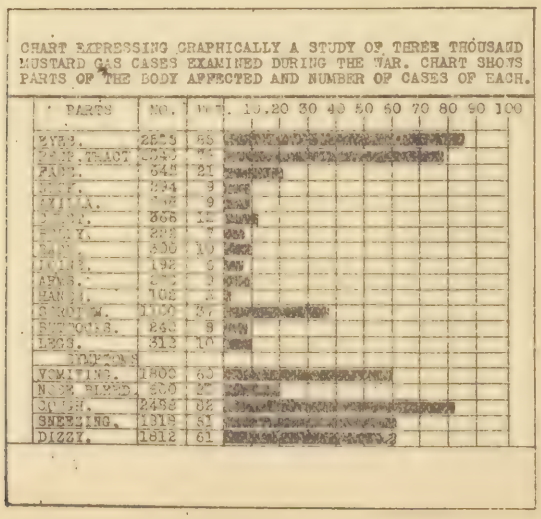


Chart No. 5 expresses graphically parts of the body affected by mustard gas.



GENERAL CONSIDERATIONS.

The primary action of warfare gases may be rather complex, a number of different organs in the body being simultaneously affected to degrees that vary with the concentrations of the gas and the duration of the exposure. Frequently, however, their action tends to be specific in the sense that it is mainly limited to some particular part of the body, at least when the concentration of the gas is low, It is possible, therefore, to group these gases, as shown later, into classes according to the most prominent physiological effect that they cause, though it must be recognized that this grouping is only a rough one as the different classes overlap one another a good deal.

ACTION	GAS	BOILING POINT Degrees Centigrade
	(Chlorine	33.5
	(Phosgene	8.0
1. Lung Irritants	(Chloroformate of Palite	77.0
	(Chloropicrin	112.0
	(Phen-carbyl-chi	210.0
2. Sternutators	(Diphenyl-chlorarsine	333.0
	(Benzyl-Bromide	198.0
3. Lachrymators	(Xylyl	185.0
	(Bromacetone	137.0
4. Vesicants	(Yperite (Mustard Gas)	217.0

5. Direct Poisons of the Nervous system (Hydrocyanic Acid,
6. Gases interfering with the Respiratory Properties of the Blood, (Carbon Monoxide).

Lung Irritants: The main characteristic of these is; they cause irritation and damage of deeper respiratory passages and especially of the aveoli of the lungs, with resulting inflammatory exudation of fluid, and the production of acute pulmonary oedema and death by asphyxia. Some of these gases are quite effective lachrymators.

Sternubators: These cause sneezing and irritation of the nose and throat when present in very low concentrations, without causing any material effect on the lungs.

Lachrymators: Extremely low concentrations exert an intense irritant action on the eyes, and cause so profuse a flow of tears and so much pain that vision becomes impossible. In far stronger concentrations they may act as lung irritants.

Vesicants: These cause inflammation and blistering of the skin, associated with acute conjunctivitis, and intense inflammation of the respiratory passages.

Direct Poisons of the Nervous System: In sufficient concentrations these act with great rapidity, causing a cessation and finally total abolition of the functions of the central nervous system.

Gases Interfering with the Respiratory Properties of the Blood. These act in various ways. Thus arsenuated hydrogen causes destruction of the red blood corpuscles, accompanied by haemoglobinuria and Jaundice. Some cause the alteration of haemoglobin into metaemoglobin; Carbon monoxide takes the place of oxygen in combining with haemoglobin.

Some gases produce the effects with great rapidity. Thus the secretion of tears provoked by lachrymators, the loss of consciousness induced by a direct poison of the nervous system, and the sneezing caused by sternutators may ensue almost immediately after exposure to the gas. In such cases recovery is often fairly rapid when the subject leaves the gas atmosphere. In other cases marked delay often amounting to hours, may elapse after exposure to the gas before symptoms of material severity show themselves. This delay is apparent with many of the lung irritants and in the onset of the inflammatory changes caused by the vesicants.

It must be remembered that quite apart from the direct damage caused by any of these gases, secondary effects resulting from this damage may subsequently show themselves in other parts of the body.

Interference with the oxygen supply to the tissues such as may occur in the acute stage in the case of poisoning with lung irritants, or with carbon monoxide, may have a serious effect on the circulatory organs, the nervous system or other organs of the body. These secondary effects not infrequently being a factor of considerable importance in the later history of the cases. Again bacterial infection of organs damaged by gas may lead to the most serious consequences.

The action of gases on the human organism is like that of all destructive agents, a parallel being readily constructed between the action of gas filled and ordinary projectiles. The ordinary shell kills when it reaches a vital organ such as the heart, brain, or the larger blood vessels, and wounds when it affects a minor organ such as the bones of the limbs. Similarly, gas kills by the annihilation of some primary function. Hydrocyanic acid gas, for example, paralyzes the nervous system; carbon monoxide coagulates the blood, and the action of such gases as chlorine or phosgene with high concentrations, destroys lung action. A gas wounds when it destroys temporarily or permanently any function indispensable during combat. The lachrymators temporarily

destroy sight; the suffocants interfere with respiration; both producing casualties quite as serious as those produced by rifle bullets or shellsplinters. Both ordinary traumatisms and the result of gas action are accompanied by danger of infection; which, in many cases, proves of vital importance. The difference between the suppuration of gangrene of a limb through shell wound and bronchial pneumonia, caused by gas, is a difference, not of kind, but of location. From a medical point of view, therefore, gas casualties do not differ essentially from the temporary or permanent disability produced by other means of combat, with the exception that the after effects of the latter are greatly lessened.

Since warfare gas was a surprise weapon and introduced against modern rules, naturally it gained a very unsavory reputation at the beginning which resulted in its receiving a vast amount of press attention throughout the world.

The results accredited to gas during the war were greatly exaggerated, and today is blamed for more dire iniquities than have ever before been connected with any war weapon. The misguided information concerning the types and degrees of wounds produced by it, together with the progressive efforts on the part of some to intentionally misconstrue the true effects of warfare gases, has resulted in producing a curiously illogical attitude of mind on the part of the people.

Gas has assumed almost the role of a Fetish, and the part it should assume from the trend of symptoms of which so many ex-soldiers now complain, is one of great importance.

Gas has been blamed for every conceivable ailment. There is scarcely a functioning organ of the body whose disturbed action at some period of its existance, during or subsequent to its participation in the great struggle for human liberty, either at home or abroad, but has had the blame for its erratic performance laid to the door of gas. Up to the present, it has been difficult, in the face of unreliable information concerning the pathology and lesions of the internal organs ascribed to the after effects of gas, to arrive at any definite conclusions as to the role played by this agent in their causation.

There is little doubt but that gas is being blamed for many ailments for which it is in no way responsible. This statement is proven by the fact that while there were but 70,552 gas casualties in our Army, the number of applications for compensation entered at the Veterans' Bureau, from conditions attributed to gas, are greatly in excess of this number; therefore, many of those suffering from ailments attributed to warfare gases must be due to other causes. Most important among these may be mentioned the following:

1. The period of time from 1917 when we entered the war to date has offered ample opportunity for the onset of diseases totally unassociated with war exposure and which existed prior to enlistment.

2. Epidemic respiratory diseases which were so prevalent during the gas warfare period.

3. The laxity of medical examination at enlistment, thereby permitting thousands of cases of tuberculosis and other diseases to enter the service which later became casualties attributed to the effects of gas for the reason they could not be blamed to other causes..

4. Self-deception and untruthful efforts on the part of some to attribute every disability to the effects of warfare gases.

5. The general mental state produced by a desire to create interest in one's behalf.

6. General debility incident to the service demonstrated in the form of neuresthenia and general nervous collapse usually caused by conditions associated with war.

7. Errors in diagnosis, in confusing cases suffering from carbon monoxide gassing from large shells with warfare gases.

8. From the effect of excessive inhalation in cigarette smoking.

It was realized by our own Government, soon after the signing of the Armistice, that a condition similar to the one now prevailing would arise, and to that end, a Board of Medical officers was convened soon after the war at Fort Grant, Illinois, for the purpose of examining all returning soldiers claiming disabilities from the effects of gas. This Board was known as the Fort Grant Board and during their session, examined thousands of cases both individually and collectively, with a view of arriving at definite conclusions concerning the after effects of warfare gassing. In their activities, the Board went into all phases of the subject, finally classifying the cases into the following groups:

1. The apparently normal group which included about 50% of the total. In this group a careful, thorough physical examination failed to reveal any abnormalities; expansion of the chest was normal; breath sounds clear and vesicular; percussion note negative; no moist sounds, but, in the face of these apparently normal physical findings, the men complained of cough, shortness of breath on exertion, etc.

2. The second group was the bronchitic group which included about 30% of cases examined. The findings in these cases were rather definite and did not differ materially from the subacute or chronic bronchitis early encountered. The type of breathing was harsh and high-pitched throughout. Expiration was prolonged and at times interrupted, but most pronounced after exercise. Moisture in these cases was abundant. There were coarse moist rales rather evenly distritubed at the bases of the lungs.

3. The third group was characterized by the presence of emphysema. On expansion, the chest seemed moderately rigid, the movements of the diaphragm limited; expansion impaired and accessory muscles thrown into use. On palpitation tactile fremitus was markedly diminished and in some instances entirely absent. On percussion a hyperresonant sound was detected. On auscultation the breath sounds over the entire chest except the bronchial areas were much diminished.

After a general review of all cases by the Board, its findings were as follows:

1. That gas victims, irrespective of the type of gas and severity of attack sustained, showed no marked predisposition toward active pulmonary tuberculosis, or towards the re-activation of a healed or quiescent pulmonary lesion.

2. That gas victims presented little evidence of material destruction of lung tissue.

3. That gas victims with emphysema findings had a more protracted convalescence than those of the bronchial group.

Notwithstanding the report of this board and the opinions of many who had given the subject much study and who concurred in its findings, ex-soldiers were continually claiming physical ailments due to tuberculosis and other respiratory diseases, attributed to warfare gases.

After carefully studying the different phases of the

subject, the clinical and pathological conditions resulting from the immediate effects of gas poisoning , the large number of persons suffering from causes attributed to the after effects of warfare gas, who were not gassed enough to produce immediate effects, and other circumstances intimately associated with the subject, it is apparent these must also be given due consideration before final conclusions are drawn.

Warfare gases are a combination of drugs, an analysis of which shows their ingredients or elements are factors which are prescribed daily in the general practice of medicine, Chlorine and Hydrochloric Acid being the most important.

We know that rational doses of these drugs cause no ill effects; we also know the consequences following the administration of overdoses. We also know without the immediate serious effects of an overdose, there could be no possibility of harmful ones appearing later. The same rule can be applied to an overdose or overindulgence of anything, whether it be drugs, food, or exercise, but in all cases the result of such overindulgence would become apparent almost immediately, and without which there could be no delayed serious after effects. Just so with warfare gases. There is no doubt but gas is responsible for some ailments, but not all.

CHANGE OF ENVIRONMENT

It must not be forgotten that the majority of the men participating in the World War left good homes in which all the comforts existed; that upon entering the Army they adopted new modes of living, entirely different from those to which most of them were accustomed. Those who went to Europe were housed in all manner of places, some sanitary, others not. They were crowded in groups, whereas previous to the war, most of them had lived lives apart from contact with large bodies of men. As a result of these conditions, as has always been the case in large mobilizations, many diseases were prevalent, particularly those of the respiratory group.

EPIDEMIC OF RESPIRATORY DISEASES.

In the early autumn of 1918, or during the gas warfare period, an overwhelming epidemic of influenza with a fatal form of pneumonia occurred. As a result of this epidemic, out of 2,518,499 officers and men in the United States Army, there were 688,869 admissions to the hospitals of which number 39,701 died.

As a rule, this epidemic was of a severe type causing profound changes in the lungs; some of which because of the extent of injury to the tissues necessarily left permanent changes in

these organs. In every instance, however, in which the lesions of the influenza were severe enough to cause such permanent changes prolonged hospitalisation resulted, and the accompanying conditions invariably prostrated the patients and totally incapacitated them for service over considerable periods of time. These lesions were, as a rule, necrosis and abscess formations in various parts of the lungs, both in the alveolar portions and also in the bronchi. In some cases, fibrous or connective tissue replacements remain as evidences of these changes, together with dilatations of the bronchi which are commonly designated as bronchiectasis. These changes are perfectly tangible and give their evidence both in physical signs and in X-ray pictures.

In the early stages of influenza and in the subjects of inhalation of poison gas are found conditions very closely allied. The toxin of the disease increases the blood supply in the lung and destroys the epithelium with which it comes in contact, even so does the poison gas. If the destruction does not extend to the deeper tissues both processes are healed and leave no permanent changes. If in the case of influenza, further infection continues with any of the various organisms, Streptococcus, Pneumococcus, etc., pneumonia are produced with thickening of the tissue around and between the bronchi which becomes more or less perfectly healed and resolved according to the duration of the process in the individual patient. In either case the primary response to the exciting agent, be it the organisms producing influenza or the poison gas, if severe enough, death will follow within relatively few hours. If death does not occur, and necrosis of tissue has been extensive in the poison gas cases, the same changes will take place as occurred in the influenza by means of a secondary infection with the same bacteria which was found in the lungs in the respiratory infections.

These changes will have been brought about by primary injury to the lungs by the gas and the secondary infection of these areas by pyogenic organisms.

There is presented then a picture entirely comparable with that produced by the more common respiratory diseases. The results will be of the same order and the patients will be as sick, as prostrated, and will have the same slow convalescence, and have the same general character of permanent changes as are found in the influenzas.

From the statistics already presented, it will be noted there were but 70,552 men who could have had such changes occur as a result of the inhalation of gas. Cases which did not require medical treatment at the time could not possibly have developed changes of such character as to incapacitate them for days, let alone years later, as claimed by many. Further, the examinations of such persons do not reveal those permanent changes.

The similarity between the remote effects or conditions produced by lethal gases and those of influenza has already been mentioned. Although the gas cases hospitalized were ten times less than those who entered suffering from influenza, the claims for compensation for conditions resulting from effects of gases are nearly one-half as great as those attributed to influenza. This is very significant, especially considering that many who had suffered from influenza were also exposed to warfare gases sometime during their services. Considering the above, and the fact that the number of applications for compensation for conditions attributed to warfare gases greatly exceeds the number of gas casualties, it is quite probable that many of those attributing their condition to the effects of gas are suffering from the effects of influenza.

THE RELATION OF TUBERCULOSIS TO WARFARE GASES.

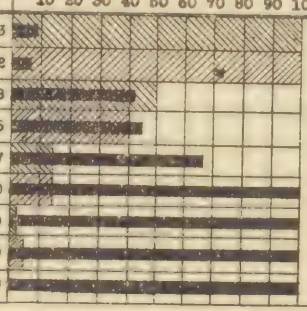
It seems to be an established fact in the minds of many that all who have been severely gassed will develop tuberculosis. Former soldiers, and many medical men, not familiar with the disease, are of this opinion. They believe that this disease is originally acquired within a relatively short period prior to the onset of tuberculosis. Perhaps a statement of a few figures which are graphically expressed on Chart No. 6 might be of interest in this respect.

CHART No 6.

GRAPHIC CHART SHOWING DISTRIBUTION OF TUBERCULOUS LESIONS AT VARIOUS AGES AS FOUND AT AUTOPSIES BY TUBERCULAR SPECIALISTS.

AGES	-TOTAL CASES- AUTOPSIES	T.B. PRESENT	DEATHS	PERCENTAGE TUBERCULAR
Under 1 yr.	43	4	4	9.3
1 to 2 yrs.	16	1	1	6.2
2 to 5 yrs.	14	6	3	42.8
5 to 10 yrs.	11	5	2	45.5
10 to 18 yrs.	9	6	1	66.7
18 to 30 yrs.	6	6	1	100.0
30 to 50 yrs.	23	23	1	100.0
50 to 70 yrs.	16	16	1	100.0
70 yrs-over.	6	6	0	100.0

EXPRESSED GRAPHICALLY
Heavy lines-percentage of cases.
Shaded lines percentage of deaths.



There appears to be a general agreement among the careful investigators that in scattered populations as are present in this country, 100% will show evidence of infection before they reach the age of 30, while in the slums it is probable that all children are infected with tuberculosis before they complete their second year.

These results mean but one thing with reference to tuberculosis, namely, that all civilized countries are infected, that in that infection there is ordinarily their protection against subsequent disease, and secondary infections of serious moment do not occur. When tuberculosis becomes a manifest disease it is due, therefore, according to our best physiologists, to the reception of too large an amount of infection at the beginning or to the breaking down of the metabolism of the body, secondary to debilitating diseases or exposure. It, therefore, is not justifiable to assume that any condition, be it gas or other disease, gives rise to an original infection with tuberculosis.

Dr. James A. Miller, who made a careful investigation in relation to this subject, and whose report was published in the American Review of Tuberlosis, Volume 3, page 354, states that are fewer cases of tuberculosis today than there were prior to the World War.

Instead of the war increasing the number of tubercular cases, it has lessened them, this being especially true in the different armies, as shown by the following table:

Tuberculosis in Armies.

France	Early months of the war----------	1.75
	Last two years of the war----------	.63
Great Britain	Before the war, entire army---------	1.1
	First 17 months of war, entire Army-	1.1
Belgium	Before war, entire army----------	.35
	During the war, entire army---------	.26
United States	Regular Army 1917-1918----------	.75
	National Army, during the war-------	.67

COMPARISON OF TUBERCULOSIS AMONGST GASSED IN THE ARMY WITH THOSE NOT GASSED.

On page 103 of the Surgeon General's Report for 1920, there is found the following paragraph:

> "One hundred and seventy-three cases of tuberculosis occurred during 1918 among the 70,552 men who had been gassed in action. Of this number, 78 had been gassed by gas, kind not specified; 8 by chlorine; 65 by mustard; and 22 by phosgene. The number of cases of tuberculosis for each 1,000 men gassed was 2.45. Since the annual rate of occurrence for tuberculosis among enlisted men serving in Europe in 1918 was 3.50, and in 1919, 4.30 per 1,000, it would seem to be apparent that tuberculosis did not occur any more frequently among the soldiers who had been gassed than among those who had not been."

The above is a most remarkable showing. In brief, it shows that in the year 1918 there were 1½ times as many cases of tu-

berculosis per 1,000 among all troops in France as there were among those gassed, and that in 1919 there were more than $1\frac{3}{4}$ times as many tuberculosis cases per thousand among all troops as there were among the gassed troops. This means that if gassing were not an actual deterrent to tuberculosis, the small percentage of tubercular cases among the gassed can only be accounted for through the care of those patients in hospitals.

MUSTARD GAS RETARDS DEVELOPMENT OF TUBERCULOSIS.

Report by the John McCormick Institute for Infectious Disease. Extract from the Journal of Infectious Diseases, March, 1921.

Mustard gas in 0.1% strength in 25% glycerol containing virulent human tubercle bacilli and injected subcutaneously into guinea pigs entirely prevented the development of systemic tuberculosis in these animals; even 0.01% mustard gas has a distinct retarding influence on the development of tuberculosis in these animals. This action could not be due to the tissue destructive action of the mustard gas in these concentrations, since the same results were obtained in the absence of ulcers.

The relationship between gassing and tuberculosis seems to be so definitely settled in the minds of many that inquiries are constantly being received from apparently healthy persons who at one time or other were gassed, as to the probable time when they can expect to develop tuberculosis.

The following article by Dr. John B. Hawes of Boston, who has had extensive opportunities to see many cases of this character, is of such interest in this connection, that it is published:

> "During the past year, among other duties, I have acted as regional consultant in diseases of the chest for the New England District of the United States Public Health Service. I have seen, usually at my office, but occassionally at hospitals, sanatoria, or in their own homes, several hundred men in whom there was some question as to tuberculosis, and indeed, in the greater number of whom a definite diagnosis of tuberculosis had already been made. I have treated and examined these men exactly as I would my own patients, so that I have had a good opportunity to talk with them frankly and to come to a definite diagnosis in each instance. It is true that, in many cases, I have not had the help of x-ray examinations nor of

temperature and pulse observations. I see these men usually only once. They tell me their story, usually very frankly, and I believe, honestly. I then examine them, weigh the evidence, and endeavor to come to a fair conclusion. As I said before, the great majority of these men have already been tagged as consumptives.

Sometimes I feel that the world, or at least this part of it, is tuberculosis mad. Ten or fifteen years ago, I stepped in "where angels fear to tread", and made diagnoses of early pulmonary tuberculosis in cases where there was no positive sputum, and urged others to do the same and not to wait, as was the custom at that time, until the sputum became positive. This, the younger physicians, especially, have done with a vengeance and with splindid enthusiasm, so that now one of my chief functions in life, at least as far as my work with the Public Health Service is concerned, appears to be that of an "unmaker of diagnoses of pulmonary tuberculosis". It is an easy thing to pass the buck to the other fellow, to take the easier course, and to say, "Here is a man with a cough who has lost weight and strength; the x-ray shows some suspicious spots; let us call it tuberculosis, anyway, and send him to a sanitarium." And so to add to his other troubles, the poor fellow is tagged with tuberculosis, whether or not, it was gas, influenza, trench or barrack-room bronchitis, or simply nervous exhaustion, that was the true cause of his symptoms. Those men who were gassed in France during the summer and fall of 1918, are striking examples of such errors in diagnosis. Far too many of them, as my own figures will show, as well as the testimony of others, have already been classified as consumptives.

Now, in order to understand and explain the symptoms and signs found at the present time in these men who were gassed over two years ago, it is necessary to know as far as possible, exactly what these irritating gases do, and have done, to the lungs and to other parts of the respiratory tract. Of the immediate effects of gas, we know a great deal, from clinical and pathological sources, as well as from animal experimentation. Of the late effects, and as to what is now going on in the

lungs of those men gassed in 1918, whom I am now constantly seeing, we know remarkably little. In a general way, we do know, however, that such gases owe their efficiency to their irritative and esharotic effects on the respiratory tract, and that the contraction of the scars thus produced may, and often does, lead to serious and progressive mechanical difficulties, not only to the ingress and egress of air into the bronchi, bronchioli and alveoli, but to the pulmonary circulation as well. It is also known that these gases have a certain selective action; mustard gas, for instance, affecting chiefly the upper air passages, while chlorine gas injures the lining of the entire respiratory tract, resulting, frequently, in chronic lung lesions. Phosgene, least severe in its immediate effects upon the lungs, for this very reason, perhaps, owing to Nature's effort to heal, often leads to serious injury to the lung tissue. Further details as to the exact pathology of the effects of gas on lung tissue are difficult to obtain, and, indeed, are unnecessary in the present discussion. Suffice it to say that the basis of these changes caused by gas is a proliferative fibrosis which destroys, to a greater extent, as the case may be, the natural protective properties of the bronchi and leads to their invasion by secondary organisms. While tuberculosis may play a part in this secondary invasion, in my own experience at least, it is a very minor one.

As would naturally be expected from the pathology of this condition, x-ray examination of the lungs in these gas cases shows a very definite picture. There is usually considerable increase in the tissues around the hilus of the lung, marked increase of peribronchial tissues extending toward, but rarely into, the parenthryma and more toward the bases than upward. The apices themselves are usually clear. In addition to this, there are often localized areas of dense fibrosis.

There are two groups of symptoms presented by these gas cases as they appear at present -- signs and symptoms referred to the lungs and the constitutional group. Prominent among the first are:

1. Cough.
2. Sputum.
3. Hemorrhage.
4. Pain, or a sense of constriction in the chest.
5. Dullness, usually at the bases, and due to a thickened pleura.
6. Diminished voice and breath sounds due to the same cause, and
7. Rales of every variety and description.

Among the constitutional symptoms are:

1. Loss of strength and ease of fatigue.
2. Shortness of breath.
3. Signs and symptoms of a marked psychoneurosis, such as a tendency to dilate upon and exaggerate symptoms in every way, along with increased reflexes.

This last group, which I regard as most characteristic of this condition, is a difficult one to judge correctly without doing the patient injustice. Fever, rapid pulse, loss of weight, anemia, and other symptoms characteristic of tuberculosis, are conspicuous by their absence. And yet the majority of these men have been, and are, constantly diagnosed as having pulmonary tuberculosis. These men often give a history of sudden, acute, febrile attacks with, or often without, cough and sputm. These attacks come on out of a clear sky and are accompanied by a high fever; they disappear as suddenly as they come, leaving a feeling of intense lassitude, which lasts for a considerable time. Such sudden attacks are very characteristic of these late gas cases.

In 1916, Tovell and Elliott (1) basing their observations on a series of 100 cases of gas poisoning, comment on the frequent persistence of symptoms related to shell-shock, along with bronchitis, often lasting over a year. In a later communication, in 1917 (2) they confirm what they stated in 1916, that it is rare for tuberculosis to become activated by gas poisoning. "They may have many of the symptoms of early tuberculosis. They require rest and

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(1) Internal. Journal of Surgery. December, 1916.
(2) Elliott: Trans.National Tuberculosis Association. Thirteenth Annual meeting, 1917. p. 62.

out-of-door treatment, but comparatively few of them have tuberculosis." With this statement I am in hearty accord. Stewart, Miller, and others in this country, as well as French observers, are of the same opinion, namely, that gas poisoning only rarely causes or activates tuberculosis.

In looking over 35 gas cases that I have taken at random from my files among the men whom I have examined during the past eight months, I have noted various points of interest. These I have briefly summarized as follows:

All of these 35 men had either been definitely diagnosed as having pulmonary tuberculosis, or else were classed as "Tb. suspects". In only eight instances, however, was I able to confirm this diagnosis, and in only one case did I find any signs of active tuberculosis. Cough and sputum, certainly prominent symptoms of tuberculosis, were present in 28 and 25 cases, respectively, while 20 out of the 35 complained of shortness of breath, and 18 of loss of strength. There were nine, or about 25%, who gave a history, at least, of having raised blood or bloody mucous. Loss of weight was a comparatively rare symptom, and, in the majority of instances, these men gave appearance of good health and were well developed and nourished. The temperature and pulse were usually normal, and in only four cases was the blood pressure abnormally low. Coming to the physical examination of the chest, I did not find the striking resemblance to tuberculosis that is present in the symptometology of these cases. Localized dullness, with or without dry, sticky rales at the base of the lungs, was the striking feature present in the majority, except in the eight men whom I diagnosed as having tuberculous process. The signs in these eight, naturally enough, were at the apices, except in one instance, where there had been a pleurisy with effusion. Thus, out of these 35 men who had been gassed over two years ago, and who had been definitely diagnosed either as having pulmonary tuberculosis or suspected of having it, and who came to me complaining of coughing, the raising of sputum, loss of strength and shortness of breath, there were only eight in whom I could satisfy myself that there had been

tuberculosis, and only one who had any signs of an active process.

Here, then, is a difficult problem. How are we going to pick from this group of men, of whom 35 that I have here given are striking examples, those who really have tuberculosis, and separate them from the great majority of their fellows who are suffering from the after-effects of gas on the lungs, and especially from the nervous exhaustion and shock to the central nervous system accompanying it. There is no short cut to this goal. Time, thoroughness, and common sense, along with a patient and detailed history-taking and physical examination, and the requisites necessary to reach a correct diagnosis.

I do not believe that this work can be done wholesale. It is absolutely necessary to obtain the man's confidence and to make him firmly believe that he is listening to an interested and sympathetic advisor. There are, in addition, certain points that will help in coming to a right conclusion; -- first, the general appearance of health and strength in these men in contrast to the apparent severity of the symptoms of which they complain. I have had many men weighing over 175 pounds, of a good healthy color and appearance, with splendid muscular development , tell me that they were made miserable by constant coughing and raising of sputum, and that it was a great exertion to go upstairs, and that to run, even a hundred yards, was impossible. To tell these men, and to take it for granted, that they were malingerers or were wilfully exaggerating their symptoms, would accomplish nothing, and, in addition, would be an act of extreme injustice. While in many cases the desire to obtain the top limit of compensation and total disability is a factor, I do not believe that it is such an important one as generally believed to be the case, as far as I can judge from my own experience. I do not feel, however, that if tuberculosis were the cause of the symptoms, such as cough, sputum and hemorrhages as described by these men, they would be vastly sicker than they really were. This is important to bear in mind.

Next of importance is the fact that the changes in the lungs are found chiefly at the bases and rarely at the apices, and that these changes consist of a thickened pleura and a bronchitis, localized, or generalized, with no evidence of consolidation or cavity formation. The fact that the temperature and pulse are usually normal, and that such would not be the case in an equal number of men with active pulmonary tuberculosis, should also be borne in mind. Whenever possible, detailed observations of the temperature and pulse, and x-ray examination should be obtained. This, however, in my own work, at least, I can rarely have done. A sputum constantly negative over numerous examinations, is additional evidence against tuberculosis.

As far as treatment is concerned, there is often very little difference between that needed by these men suffering from the late effects of gas poisoning and those who really have consumption, except that the latter should go to a sanitarium or hospital and the former should not. Rest, away from a medical atmosphere, and particularly, sympathy and encouragement will bring the best results. Our Public Health Hospitals, Sanitariums, and Convalescent homes are full of these men. Many of them are discontented and unhappy, and are firmly convinced that even if they have been definitely told that they have no consumption, the truth is simply being kept from them. I cannot overstate the importance of telling these men frankly that, although they are not in good condition, and still need treatment and supervision, they need not worry about having tuberculosis, so that this load at least, may be taken off their minds.

The problem is a difficult one, but I feel sure that thoroughness, patience, attention to the striking points of difference between the symptom-complex of late gas poisoning as outlined above and tuberculosis, as well as sympathy and encouragement to the patient, will, in the long run, bring about the best results.

The points to be remembered are the following:

(1) Do not take it for granted that a given process is tuberculous, even with a suggestive x-ray.

(2) Do not do the reverse.

(3) A general appearance of robust health, with marked symptoms, is against tuberculosis.

(4) Bear in mind that the lung complications resulting from gas are usually basal and not apical processes.

(5) And that the usual signs found are those of a thickened pleura and often a localized bronchitis.

(6) And further, that following gas, there is apt to be a marked increase in nervous symptoms of every kind.

(7) Do not take it for granted that these men who have been gassed are not sick and do not need treatment, even if you decide that they do not have tuberculosis, or indeed, not much wrong with their lungs in any way.

(8) Treat the man who has been gassed and not his lungs".

CONFUSING CARBON MONOXIDE POISONING WITH POISONING BY WARFARE GASES.

There is no doubt that many casualties attributed to warfare gases were poisoned by the action of carbon monoxide from the explosion of large shells. It might be interesting, in this connection, to state that in the German medical history of the war, greater space has been devoted to the casualties produced by carbon monoxide gas than to warfare gases. The following has been extracted from the report of Professor Oscar Linkowski, Consulting Officer of the Ninth German Army. He states that poisoning by carbon monoxide was very frequent in the World War, which to a large extent, was due to the enormously large amount of carbon monoxide generated from the explosion of H.E. shells; e.g., 61% from picric acid, 37% from trinitrotoluol. The extraordinarily powerful effects of this gas, whose affinity with hemoglobin is 200 times greater than that of oxygen, and of

which one-fourth per cent in the atmosphere issufficient to change 60% of the blood pigment to carbon monoxide hemoglobin, had made it possible for explosions in badly ventilated spaces, in subterranean galleries and dug-outs, to produce the most severe and even immediately fatal cases of carbon monoxide, poisoning in which in many cases were considered due to poison gases introduced by the enemy. He states that even in the depths of shell craters, it was possible for quantities of carbon monoxide to accumulate in rare cases and cause severe gassing to those who frequent such places at later periods.

In his report, he laid stress to poisoning by carbon monoxide in spaces in which explosive gases did not originate immediately but which penetrated by diffusion through the permeable soil from locations at considerable distances from the point of explosion. As pure carbon monoxide is odorless, poisoning produced by it is hard to diagnose, especially if some mustard or other poisonous gases had been used at the time. The frequency of carbon monoxide poisoning among the German troops was certainly much greater than reported. He further states that many, perhaps most, of the fatalities with grave loss of consciousness and attributed to other causes, were, in reality, due to carbon monoxide poisoning from exploded gases.

Studying the sumptoms and after-effects of many of our gas casualties, there is no doubt that a large number of them were due to carbon monoxide poisoning resulting from the explosion of heavy shells.

EXCESSIVE SMOKING IN CONNECTION WITH RESPIRATORY TROUBLES.

As is well known, the majority of our soldiers smoked excessively during certain periods of the campaign, and many of those now suffering from chronic bronchitis and other respiratory conditions are still inveterate smokers. For example, on a recent trip, an opportunity was afforded forthe examining of an applicant for compensation for respiratory conditions supposed to have been due to gassing. From the history of the case, this man was but slightly gassed. In fact, to such a small degree that he was not hospitalized at the time. Since the war, however, he has been troubled with a chronic cough. In examining this man it was detected that he was a slave to cigarettes, smoking from 60 to 100 daily.

Tobacco, whose active principle is nicotine, is a very poisonous alkaloid. It is a colorless, oily, transparent, liquid having an acrid burning taste and after some exposure to the air, the odor of tobacco. In many heavy smokers, chronic pharyngitis is very common. Also, chronic laryngitis may result from inhalation. Ambolopia, in which the loss of sight is gradual in

both eyes, may also result from this cause. It affects principally the center of vision. Chronic bronchitis may also be due to this habit. Therefore, is it not possible that in persistent smokers the tobacco is one of the causes for conditions now attributable to warfare gases.

AUTOPSY FINDINGS

Every effort has been made to obtain reports of autopsies conducted on cases dying from remote effects of warfare gasses. The subject was not only taken up through the questionnaires sent out but also directly with the Commanding Officers of many of the larger Hospitals where ex-soldiers were being treated for conditions attributed to the effects of warfare gases.

Unfortunately no reports have been received. Of the returned questionnaires none contained any information on the subject. In many cases the notation being made, "no deaths from this cause". It is quite significant that of the large number of soldiers suffering from tuberculosis and other diseases attributed to the after effects of warfare gases, no deaths have occurred.

ANIMAL EXPERIMENTATION

Although much animal experimentation has been carried on at the laboratories at Edgewood Arsenal and other places in connection with this subject, the work, thus far, has not progressed to such a degree as to arrive at definite findings.

Much work of this character was done by Professor Winternitz and his assistants at Yale University during and immediately following the war. Unfortunately, however, the time intervening between gassing of the animals and autopsy findings was of such short duration that it is not strictly applicable to present day conditions.

The following extracts from Professor Winternitz's report are published. They refer to the remote effects of warfare gases on animals dying from a few days to six months following gassing.

Winternitz in his reports stated the majority of the animals experimented upon were in good health. Others, however, were lean, sluggish and of a sickly appearance. Of the dogs that died all were poorly nourished and greatly emaciated from the effects of the gas. As a rule, the organs of the body resembled those associated with any chronic infection, there being more or less pallor of the abdominal viscera, and often fatty changes

in the liver and kidneys. The spleen was usually enlarged. The pleura was normal. The lungs were not voluminous. As a rule, they collapsed when the chest was opened, freely exposing the pericardium and heart.

There was no edema of the mediastinal tissues and no fluid or exudate in the trachea. The heart was little altered. There was no dilatation of the cavities and no microscopic changes in the endocardial lining. In no instance was vegetations found on the valves.

The larger bronchi were not markedly changed, but the smallest bronchial tubes were often found to be thick walled, greatly dilated, and plugged with exudate.

In many cases, the lungs presented areas of atelectasis, while the rest of the lung was irregularly emphysematous. The extent of the atelectasis and associated bronchial changes varied considerably.

The lesions found in the group of "chronic gassed dogs" were such as might have been expected from the findings in acute and sub-acute states. The infections started very early after gassing, persisting and resulting in bronchiectasis. These infections produced lesions which were demonstrable in dogs that died or were killed six months after gassing.

HEMORRHAGES IN THE LUNGS OF ANIMALS THAT SURVIVED EXPOSURES TO POISONOUS GASES.

In regard to the hemorrhage phases of gassing, Winternitz arrived at the following conclusions:

1. The chronic inflammatory and reparative changes in gassed lungs create a condition favorable to hemorrhage.

2. Hemorrhages are induced in such lungs by sudden increase in blood pressure.

3. Hemorrhages may lead to further scarring of the lung, which again favors bleeding, thus constituting a vicious circle.

EXAMINATION OF THE BLOOD

An unsuccessful effort has been made to obtain reports on blood examinations especially as to hemoglobin and range percentages. Unfortunately, most of the cases now suffering from

remote effects of warfare gases, are also suffering from other ailments, and as a result, a differentiation has been impossible.

Of the few cases reported in which the red cells were enumerated, the highest amount was 6,900,000 per C.M., with a hemoglobin percentage of 118. In all cases, the color index ranged from .8 to 1. iIn cases of chronic bronchitis, there was a polymorph-leucocytosis. In other cases, there was no increase in white cells. Unfortunately, however, the length of time intervening between gassing and blood examination was not given.

ANALYSIS OF OVER ONE THOUSAND APPLICATIONS
FOR COMPENSATION FILED WITH THE VETERANS' BUREAU
FOR EX-SOLDIERS

At the beginning of this investigation, the necessity for obtaining information concerning the nature of the claims for compensation filed by ex-soldiers, was apparent, and to that end, a careful analysis was made of some 1100 applications in the Veterans' Bureau in Washington.

In conducting this work, only such cases were analysed as claimed compensation for diseases associated with gassing and were confined to the following:

1. Tuberculosis
2. Asthma
3. Bronchitis
4. Diseases of the heart
5. Diseases of the kidney
6. Rheumatism

Owing to the fact that the claims were not classified according to the diseases, it was necessary to take the cases at random and not for any particular reason.

The cases selected were from the district embracing the States of Delaware, Virginia, West Virginia, and the District of Columbia. As a result of this analysis, it was found that 31% of the entire number claimed gas responsible for their disabilities. In those cases attributing gas responsible, every effort was made to determine, if possible, the kind of gases causing the same, the immediate effects notices, reasons for thinking they were gassed, the symptoms following gassing, medical attention received, if any, hospital where treated, length of treatment, and the period of time they were separated from their commands.

The following table has been prepared from this information:

Missing pages 31-33

(Pages 31- 33 are details of the following recapitulation which time did not permit of inserting herein).

RECAPITULATION

Number of Cases Examined 1036
Number of Cases Claiming Gas ..... 353 = 34%

Diseases Checked	Number	Due to Gas	Percentage.
Tuberculosis	554	125	22.5
Bronchitis	261	192	73.5
Heart Disease	155	22	14.
Asthma	29	12	41.4
Rheumatism	15	1	7.
Nephritis	22	1	4.5

Principal Places Where Gassing Took Place.

Argonne	100
Chateau Thierry	29
Verdun	27
St.Mihiel	15
Champagne	12
Soissons	10
Unknown	96
Other	64

Rank	Number
Majors	1
Captains	5
1st Lts.	12
2nd Lts.	2
Sergeants	30
Corporals	37
Privates	253
Cooks	7
Buglers	1
Mechanics	3
Wagoners	1
Unknown	1

Race

White	331.
Colored	22.

Apparently not gassed 103
Apparently slightly gassed 45

In studying the table, its incompleteness is quite apparent, a large percentage of the essential items being missing, especially those pertaining to the places where gassed, hospital where treated, and length of such treatment. This incompleteness was due to the condition of the papers and records filed in the Veterans' Bureau.

Of the 1,036 cases analyzed, 363 attributed their ailments to the effects of gas and 683 to other causes. Of the entire number, 554 claimed tuberculosis as the cause of their disability, and of this number 125 or 22.5% attributed the disease to the effects of warfare gases. There were 261 cases of bronchitis, of which 192, or 73.5%, claimed gas responsible; of the 155 cases of heart diseases, (all kinds) 22 claimed gas responsible. Of the 29 cases of asthma examined, 12 attributed their condition to the effect of gassing. Of the 15 cases of rheumatism and 22 cases of nephritis, but one each was attributed to the effects of warfare gases.

In studying the chart, it will be observed the principal places where gassing occurred were in the Argonne Forest. Of the 353 cases ennumerated, 103 stated they were so slightly gassed that hospital treatment was not required, 45 others required only first aid treatment.

The similarity of ailments complained of by many who were gassed was marked. The principal group of symptoms more or less common were general weakness on exertion, shortness of breath, rapidity of heart action, loss of appetite, loss of weight, dizziness, pains over different parts of the chest and lower extremities. A large number of the cases complained of insomnia or disturbed sleep, of various degrees. Many complained of dry hacking cough, and a constant desire to expectorate. Nervous diseases of every variety were enumerated.

It was quite significant in this analysis, that those presenting the largest number of complaints gave histories of but slight gassing with little or no hospitalization at the time.

Although the cases examined and enumerated on the chart represented but a very small part of those filed with the Veterans' Bureau, the number claiming gas responsible for their ailments serves the purpose of giving a fair percentage of the entire number.

OPINIONS OF MEDICAL RESERVE OFFICERS CONCERNING THE AFTER EFFECTS OF WARFARE GASES.

Many Medical Offiders of the Reserve Corps of the United States Army had extensive experience with gassed cases both in France and since returning to this country.

With a view of obtaining their opinions, the following letter was addressed to them.

"My dear Doctor:

I am taking the liberty of writing you for your opinion concerning a subject, which at this time if of the greatest importance. As you probably know the use of toxic gases was employed extensively during the late war resulting in hundreds of thousands of casualties, including large numbers among our own forces.

"Due to the fact that gas was a wholly new and unknown factor, and also, to the fact that it affected the respiratory system principally, it has been difficult not only to determine the amount of damage done to this system, but also to other internal organs of the body. For this reason, gas is now and will be unquestionably, for years to come, be blamed for many ailments for which it is in no way responsible. Unfortunately, Medical literature, both domestic and foreign, relative to the after effects of gas on the internal organs of the body are rather negative.

"It seems to be the consensus of opinion of those who have given the subject the closest study, that there is no apparent reason why those subjected to gas should suffer any permanent effects.

"At Fort Grant in 1919 a Board of Medical Officers of the Army examined over two thousand men who were gassed, and after careful individual and group examination and comparison, arrived at the following definite conclusions:

(a) That gas victims, irrespective of the type of gas and severity of attack sustained showed no marked predisposition toward pulmonary tuberculosis, or toward the re-activation of a healed or quiescent pulmonary lesion.

(b) That gas victims presented little evidence of material destruction of lung tissues.

"Notwithstanding the report of this Board and the opinions of others who have given the subject much study and who concurred in the findings of the Fort Grant Board, former service men are breaking down at an alarming rate from tuberculosis and lung troubles, and a large percentage of them attribute their conditions to the remote effects of war gases.

"There is no doubt many ex-soldiers are suffering from the ill effects of warfare gases, but on the other hand a large number are not, and in justice to them and to the Government, it is of the greatest importance to know the exact after effects of this new war weapon.

"It is believed the only logical means of obtaining this information is from medical men whochave encountered cases of this character, and to that end I am addressing this communication to you for the purpose of obtaining your opinion on the subject.

"In view of the importance of this matter and its far-reaching results, it is earnestly requested the subject be given careful consideration and I assure you any information will be greatly appreciated.

"Trusting to hear from you on this matter, I remain

Very respectfully".

It is pleasing to note that of the two hundred letters sent out, one hundred and thirty replies were returned and those expressing definite views are herewith appended. Considering the extensive experience these writers have had, both in France and at home, their views on the subject are most valuable.

No. 1. April 25, 1921.

"Having seen many thousand acute poison gas cases, among both the B. E.F. and the A.E.F. in France, and having lectured on the subject at the Sanitary School at Langres, I am greatly interested in the subject of injury as set forth in your letter of April 23rd.

"Since my discharge from the army I have seen a fair number of cases referred by the Public Health Service to the Pennsylaania Hospital, of men who claimed to have been gassed, and who were suffering from various disorders. Many

of these were, so far as I was able to determine, Malingerers seeking compensation, whose own account of their gassing was such as to preclude the possibility of an toxic effect. Others I think honestly believed that the various symptoms from which they suffered, such as indigestion, epigastric pain, dyspnea, fatigue, etc., were actually the result of their being gassed. The majority of these cases impressed me as being due to other factors and quite unconnected with gas poison effects. I have seen two or three men who continued more or less asthmatic and dyspneic, with moist rales in the chest, and dyspnea on exertion, in which it seemed that either phosgene or yperite had probably been the causative factor. I have seen no evidences of latent tuberculosis being stirred to activity by gassing.

"I fear that this letter will be of little use to you, as it is simply based upon my personal experience.

"G.W.N." Philadelphia.

No. 2. April 25, 1921.

"As Chief Medical Officer of C.H. 27, A.E.F.--- from April 7, to December 15, 1918, I had the opportunity of seeing the immediate effects of gassed patients, French and American, I can safely say, the number of 800 or more and can believe A and B of the Fort Grant (1919) series. It was during that time, yes, even earlier, when we were with the British on Vimy Sector, that I recognised the physic effect of gas upon the individual. This was further confirmed in the patients that I personally took care of. Also since the war, so that I am firmly of the opinion that the physic element is a big factor, and is the basis of many of the applications of disability pensions.

"To begin with, our chiefs permitted a gold chevron on the right arm (wound) for gas. This led many a man to appear before his M.C. shamming respiratory distress. The M.C. whose orders were to take no chances, shipped him to the rear, with field Medical Card diagnoses "gassed". As such, I received my small portion and after a brief period of study, marked a vast majority Class A.

"During 1919 and 1920, since returning, the only cases claiming disability on account of having been gassed were in my opinion malingering. Of course, there were a few of these as I am not associated with the post-war medical service, (W.R.I.). Be glad to be of any service to you that I can.

I realize that this letter is sort of a ramble and if it doesn't suit you, destroy".

"J.W.S." Iowa.

No. 3. April 25, 1921.

"I received your letter about War Gases. I am acting as consultant at the Polyclinic and Fox Hills Hospitals in this city and have gone over a great many men who were gassed. I have also had a great many come to me privately in consulation because they were gassed and feared they would develop tuberculosis. The consensus of opinion of the English and French surgeons was distinctly that it did not predispose nor did it reactivate old tuberculosis lesions. In this, my experience is in very marked accord. The experience that I have had in listening to men is that they have shown an increase in the harshness of their respiratory murmer as if there were a great increase of connective tissue throughout their bronchial ramifications. They also complain that their wind is not good and they cannot get as much wind into their lungs as formerly, that is, they do not seem tohave the amount of respiratory comfort that they formerly had in ordinary breathing. So far as I have been able to observe up to this time, the mustard gas seems to have left that increase of connective tissue throughout the finer bronchioles giving a subjective sense of dyspnea and causing a distinct harshness in their breathing as if there were healed scars and this also over the lower lobe behind.

"This is as far as I can state anything definitely up to date but as you know, I am very interested in this subject and if I find any more information I will let you know".

"A.L." New York City.

No. 4. April 25, 1921.

"As I only do surgery, I have had little opportunity to determine if there are any late effects from "Gassing". I have, however, had in my surgical services a great many ex-soldiers who have made all sorts of claims in regard to the ill effects of gas. Most of these have been palpably ridiculous".

"J.A.G.", Philadelphia.

No. 5. April 25, 1921.

"In my opinion there is doubt as to the lighting up of a previous tuberculosis infection but there may be cases in which the cause of the flaring up of an old infection might point to an exposure to gas as a prominent factor.

"No cases under my observation have shown any permanent injury from gas exposure, unless we except some questionable cases of tuberculosis".

"J.W. Van D.". Chicago.

No. 6. April 25, 1921.

"I have your letter of inquiry of the 23rd instant concerning my opinion as to the permanent effects of poison gas.

"Everything that I know about this condition seems to support the conclusion of the Board of Medical Officers quoted in your letter, that recognizable permanent damage to the lungs from poison gas is extremely rare. There is, so far as I know, no evidence that tuberculosis is favored by such exposures to poison gas".

"L.A. C." New York City.

No. 7.

"In reply to your letter of April 23rd, relative to gas victims, I wish to say that my experience has been limited to the x-ray examination of the chests of only a small number. In none of these examined have I found any pathological change that I could say was definitely due to gas. Most of these chests showed that we have been in the habit of calling thickening of bronchial trunks with a little more density than is found in the average individual. I do not recall having seen any cases in which there was definite evidence of destruction, in fact, the findings have been those of an irritative bronchitis.

"My experience has been so limited that I hardly feel that it is of very much value and regret that I cannot give you facts that would be of help to you in this work".

"H.E.A.". Baltimore.

No. 8. April 25, 1921.

"I have your letter of the 22nd in reference to the after effects of gas cases. Since my return from the Service I have had the opportunity to examine a number of men gassed in France and who ascribed all manner of ills to the gassing. In the majority of these cases the symptoms were apparently neurotic, in others there was definite evidence of chronic bronchitis and tuberculosis but I do not remember a single case in which I felt that the lesions could be ascribed definitely to the exposure to gas. An interesting fact in many of these latter cases was that they could give no history of having been seriously affected at the time of exposure, while in other cases where there was a definite history of severe initial injury there was no lesion present in the lungs.

"I, therefore, coincide with the findings of the Fort Grant Board and I also feel that, owing to the fear which was prevalent of the horrible effects of the gas, which was possibly increased by our teachings in gas defense, there was a marked and permanent mental impression made upon that large group of service men who were substandard in their nervous equilibrium which is responsible for the multitude of ills now ascribed to being gassed. I have been rather interested in this work in that for two years my service was entirely that of instructor in gas defense at Benjamin Harrison and Greenleaf. From the information given us we told the men, in order to make them realize their danger and be more careful, that in cases of severe exposure to certain gases, particularly phosgene and mustard oil, permanent injuries would result.

"I regret that I cannot be more specific and report through studies of individual cases. Should any such cases again come under my observation or professional care in the future I will endeavor to secure data along the line of your letter and submit to you reports from time to time."

"T. B. A." Lancaster.

No. 9. April 26, 1921.

"In reply to your letter of April 23, I would say that I concur with the conclusions arrived at by the Board of Medical Officers of the Army at Fort Grant in 1919. My reasons for the same being that during eight months service in France as Chief of the Medical Service, Base Hospital No. 57, I personally examined many soldiers who had been gassed and found that they presented in almost every instance no evidence of destruction of lung tissue, further, that they

were not more prone to attacks of influenza or pneumonia than those who had not been gassed. While acting on the Camp Examining Board, Camp Dix, N.J., during June 1919, in the chest section, we could find no material damage in gassed cases. Since returning to private practice there has been little opportunity for me to follow up this line of work as my speciality is diseases of children. I can only say that the few men that I know personally who have been gassed do not show any bad effects therefrom."

"T. Le. B." Philadelphia.

No. 10. April 27, 1921.

"Replying to your request of the 23rd instant for my clinical observations and conclusions on the after effects of gas inhalation, I regret that I have no information to value to give.

"My opportunities for observation are derived from two sources; my twenty-one months service in France and Germany with combat troops, and my nineteen months work to date as Attending Specialist in Neuro-psychiatry in the Public Health Service.

"My observations and conclusions in the first capacity could add nothing to your conclusions derived from your personal experience, and at the best had little value except for immediate practical application in work with troops, although it is true that until June, 1918, we provided within the Division for the major part of complete hospitalization of recoverable cases of sickness or gas casualty.

"The second source of patients brings to me two groups of cases:- those that are clearly neuro-psychiatric at first observation and those that exhaust all other medical resources in attempt at diminution of their alleged disabilities and that are referred to me from a large portion of the State of Connecticut.

"This latter group consists chiefly of constitutional psychopaths, mental deficients, and psychoneurotics. Many of the first and last types present general tissue inadequacy, to use a descriptive term which I think serves as well as any other and applies physically as well as mentally, and of these, many cases exhibit predominant cario-vascular neurosis. These inadequate cases tend to refer their symptoms to some service relation, and among those who served at or near the front, gassing is selected as a frequent cause of their disability.

It is significant that the symptoms are fairly constant, whether the individual cases served at the front or in rear, in France or in this country.

"From my limited experiences, I conclude that the symptoms referred to gassing by the large majority of both physicians, and patients, the latter being, as a rule, either ignorant or neuropathic, and the former being of limited clinical experience, are not proven to be the result of gassing but in many cases are proven to be the result of other causes."

"P. W." Hartford, Conn.

No. 11. April 27th.

"In reply to your letter regarding the late effects of gassing on the soldier, I can only report on the clinical manifestations in some of these cases. I have seen during the past two years several ex-soldiers complaining of a variety of symptoms which they ascribed to gassing. However, in not a single one of these was I able to convince myself that the trouble was of this origin. Many of these patients were what we would ordinarily call neurasthenics. I have not seen a single case where we were able to demonstrate a tuberculosis where this could be traced to gas. Of course, please understand that the total number of cases seen has not been large, but as far as I could judge from my experience my impression is that any definite trouble of which an ex-soldier complains even for a year after his discharge he is apt to ascribe to being gassed, although in the majority of these cases there is no history of any acute gassing. They state that they were in a district where some people had been gassed and so they conclude they might have inhaled some of it."

"J. L. M." Chicago.

No. 12. April 27, 1921.

"My observation of ex-soldiers who were gassed during service has been very limited. The few that have been observed by me showed no tissue changes which could be attributed to gassing.

"The bronchial trouble which they complained of was evident according to history, prior to their entering service and in my opinion was not permanently aggravated by gas poisoning."

"A. J. L." Kansas City.

No. 13. April 28, 1921.

"Patients giving a history of gassing as an explanation of physical disability, have more or less psycho-neurosis, which is liable to mislead the observer as to the extent of actual lesion. Gastric symptoms, subjective only, were very common and were often found to be relieved by suggestion.

"Medical Officers, now two years "post hoc" report that since a comparatively mild gassing, they are certainly more responsive to states of the weather, smoke odors, etc. They believe that their respiratory hyperesthesia, sometimes resulting in dyspnea, is beyond psychic explanation.

"I did not, in the tuberculosis service, see any cases of activity that could be proved due to gassing. We reasonably expected that many were re-activated by gas, but to my surprise, these cases in time recovered from the re-activation and were then found to be within the original limits of tuberculous infection.

"At present it is impossible to prove that any tuberculosis has been caused by gassing. I do not believe that any statement to that effect is true.

"Chronic bronchitis may have had its origin in gassing".

"C. B. S." Portland, Me.

No. 14. April 28, 1921.

"Your letter of the 23rd instant at hand. Will say in reply that my opinion on the matter of the after effects of toxic gases, I fear, is not worth much as I have had very little experience with cases of this character since leaving the service. I did, however, examine a great many men while in the service who claimed to have been gassed and among them I found quite a few with a good deal of respiratory disturbance.

"A few of them had recurrences of bronchitis which made them fairly sick for a time. I have taken the position that a man who had really been gassed would never again be able to stand the same hardships that he had previous to having been gassed. I believe that exposures to these toxic gases in fairly strong concentrations leaves the respiratory system very much more liable to irritations of all kinds than it was before such exposures. I think such men will continue to break down.

"I, also, am inclined to believe that many men who are claiming disability on account of gas have never been

really gassed but make the claim because that is easy to claim and like lumbago hard to disprove. Some old tuberculosis lesions may be activated but I am not in a position to say to that."

"F. A. M." Pana, Ill.

No. 15. April 28, 1921.

"I am sorry that I hawe had no experience in the after effects of gas. I feel sure, however, that many men will try to take advantage of having been gassed and attribute all sorts of conditions to it."

"H. H. Y. Baltimore.

No. 16. April 28, 1921.

"During my services overseas it was certainly the impression of Medical Officers that gassed cases surviving the acute phases recovered completely.

"Since my return to civil life and general hospital work, I have seen but few ex-service men claiming to be suffering from the late effects of gas. In these men we could not find any evidence of pulmonary or circulatory disease of an organic sort but felt that they were psychoneurotics who referred their difficulties to gas".

"T. R. B." Baltimore.

No. 17. April 29, 1921.

"I was much interested in your letter of the 25th as it was in line with such limited experiences as I have had with soldiers subjected to toxic gases during the war.

"Of the admissions to the surgical department at Fort McPherson from September 1918 until September 1919, I do not recall any cases in which it was felt that the soldiers showed a distinct predisposition to pulmonary disease attributable to gas. While we saw the serious results of mustard gas upon the surface of the body, I was very much surprised to find so little evidence of permanent injury to the lungs. One officer on the Medical Service of rather frail physique had a cardiac weakness that was attributed to his having been gassed. This officer, however, progressively improved, and in my opinion there was some doubt as to whether gas was the only factor in his case. In a second case, also that of a Medical Officer, there is the appearance of robust health and activity, but recently the doctor told me that he could not endure severe exertion as before the war.

I know of no instance where there was evidence that pulmonary tuberculosis was determined by the previous gas poisoning. I was particularly impressed by the fact that nearly all of the returned soldiers said they had been gassed, but practically none of them showed evidences of serious injury to the lungs."

"W. W. B." Philadelphia.

No. 18. April 29, 1921.

"In reply to your communication of April 25th, the undersigned has to say:

1. That during his tour of duty as Chief Medical Service at the Fitzsimmons Hospital, U. S. A., from October 1918, its opening to July 1919, he paid especial attention to the question of gassing and the possible reactivation of a latent or a healed pulmonary tuberculosis; he was never able to convince himself by the evidence then gathered, that gassing bore any relation whatever to pulmonary lesion in existence at examination; furthermore, his examination for discharge of a considerable number of soldiers, not patients, who claimed to have been gassed, only served to convince him that the gassing had left no organic disease anywhere.

2. Since his return to civil practice, he has examined for various reasons, quite a number of ex-service men, some of whom claimed to have been gassed; not one presented the slightest trace of any resulting pulmonary disease.

3. A long experience in the use of ether anesthesia covering more than thirty-five years, with a large number of individuals having active pulmonary tuberculosis, has led to the conviction that it does not increase existing pulmonary disease in any way. While this is not closely related to the question of gassing, it easily comes under the head of collateral evidence and as such is here given place.

4. The undersigned believes that gassing does not reactivate healed, latent, or increase active pulmonary tuberculosis; however, his experience may be too limited to justify him in holding a firm conviction in the matter, and he is open to a contrary opinion when the evidence warrants assuming it."

"W. M. B". Denver, Colo.

No. 19. April 30, 1921.

"In answer to your letter of April 30, 1921, the following is offered. Generalization without statistical studies but inferences drawn from the large number of cases seen before the cases left the states for overseas service, those seen in France immediately after the Armistice, and the ex-soldiers in 1920 at home.

"In 1920, as a Public Health Service Field Examiner, the ex-soldiers were seen (B. W. B. I.) and (B. V. E.) with a history amongst others of "gassing" and I believe my records in the 5th District office will show the same results that were found at Fort Grant in 1919 by the Board of Medical Examiners. Too, I am convinced that the cardiac cases with a history of gassing gall under the category of Functional disturbances with a background of constitutional inferiority, defective physical development, and the neurotic types.

"Thus the cases seen in 1920 were the prototypes of the chronic bronchitises, and lung tuberculosis in evidence at the Camp Base Hospitals. It would seem that the gassing, except in suffocations, and severe burnings, was incidental to the life of the individual rather than a predisposing less alone and exciting factor for disabling diseases in the life of the soldier.

"You will gather and I do not wish altogether to deny the correctness of your suspicion that in my judgement actual gassing did its damage in action or immediately behind the lines and ended there.

"E. V. D. B." Chicago, Ill.

No. 20. May 2, 1921.

"In answer to your letter of April 23, 1921, I would say that I agree entirely with the findings of the Board of Medical Officers at Fort Grant in 1919."

"J. N. T." Englewood, N. J.

No. 21. May 2, 1921.

"I have your letter of recent date. I am in entire accord with you as to the importance of determining just what part, if any, exposure to chemical gases plays in the morbidity of those who claim to have been its victims, and share with you the earnest desire for more light on the subject.

"My earliest experiences with the effects of chemical gases for warfare purposes was acquired while stationed at Toul, France, with the most advanced sector of Base Hospitals, to which many thousands of gas victims were brought during the latter part of the war. They represented all the various types of gas wounds, from the superficial skin burns to the rapidly fatal bronchopulmonary and gastrointestinal lesions. There were comparatively few cases of superficial burns of the body, including those of the face, which entailed permanent disability of sufficient severity to prevent a return to duty. A few of the severe burns of the eyes entailed permanent loss or marked impairment of vision. I do not recall a case of severe burn of the upper respiratory tract, and it is probable that in the event of such lesions their significance was lost sight of in the presence of the more important symptoms referable the pulmonary and gastrointestinal organs.

"To come now to the more important phase of the subject, namely: the late effects of gas on the functions of the internal organs. There is hardly a functioning organ of the body whose disturbed activity, at some period of its existence during or subsequent to the time of its participation in the great struggle for human liberty, either at home or abroad, but has had the blame for its erratic performance laid at the door of poison gas. It is very difficult, in the face of the extreme paucity of exact information concerning the pathology of lesions of internal organs ascribed to the after effects of gas, to base any definite conclusions as to the role played by this agent in their causation.

"I admit a very meagre acquaintance with the literature on this subject, but attempts to secure information from medical men actively in contact with great numbers of these cases are not reassuring as to their grasp of a difficult situation. Indeed, I am almost convinced that they are still groping in the dark, that their labors are not clarifying the atmosphere of mystery which seems to have engulfed this vexed question.

"Gassed" has assumed almost the role of a FETICH. What part it should rightly assume in the causation of the train of symptoms of which so many of our ex-soldiers complain is an open question which we must solve.

"It has been my observation that the vast majority of claims for compensation for disability incurred from the effects of gassing have been based upon its effects on the respiratory tract. There have been relatively few complaints of disturbed gastrointestinal functions ascribed to gas. I have no observations to offer on the effects of gas on metabolism, or the blood changes incident thereto. What I have been particularly interested to note is, that in a great many of the so-called cases of gas bronchitis, I have found good

and sufficient reasons for the symptoms in the throat and nose. I think I may say truely that a majority of these cases show the presence of infected tonsils, adenoids, obstructive type of septal deviation, or paranasal sinus infection. And the proper surgical treatment of these conditions results in such a decided improvement in the patients' condition as to warrant the assumption that they played a leading role as causative agents of the bronchitis.

"The pathology of gas bronchitis, which I have heard described as a fibrosis of the bronchial mucosa, is in no way substantiated by the Roentgenological examination of these cases, insofar as they presented a pathology which could be shown by such examination. For the readings from these examinations have been peri-bronchial and peri-hilus thickening.

"I am far from convinced that bronchitis is a pathological entity, or that its true pathology varies in any essential particular from that of bronchitis from any other cause.

"As to the incidence of pulmonary tuberculosis resulting from the exposure to poison, it would seem that it is far from convincing that gas played a conspicuous role in this connection, and that I doubt if the incidence of lung tuberculosis among ex-soldiers is much greater by reason of the part that gas played in warfare".

"M. L. E." New York City.

No. 22. May 2, 1921.

"I have your letter of April 25th concerning the possible effect of gas on pulmonary tissue. I have had a great many of these cases referred to me by the Medical Examiners for neurological findings where the lung condition was negative. I have been surprised at the large number of claimants giving gas as the original cause. I am of the opinion that a very large number of these men are malingerers, seeking to get on the pension roll. Some of them belong to the psycho-neurotic group, and all together are the source of much trouble.

"M. H. B". U. S. P. H. S.

No. 23. May 3, 1921.

"As my experience has been nearly altogether surgical I did not have opportunity to handle cases of gas poisoning. In my experience incidental to surgical work I have perhaps seen about 200 men who claimed they had been gassed, none of these had any severe symptoms and in only four or

five cases have I noticed symptoms which were causing discomfort. The symptoms were such as one would see in ordinary cases of bronchitis. I am inclined to agree with the Fort Grant Board of Medical Officers mentioned in your letter.

"In a large number of surgical cases passing through General Hospital No. 3, I noticed very few symptoms in any of the cases claimed to have been gassed.

"In my capacity of Attending Specialist for the Public Health Service I have heard a great deal from men claiming to have been gassed and I have gained the impression that there is a great deal of misrepresentation both by men who claimed to have been gassed and by their families who have a tendency to attribute a large number of symptoms to a slight gas poisoning which the former soldier states that he experienced.

"I have had no experience with the effects of metabolism,chemical reaction of the blood, etc."

"H. D. C." Plainfield, N. J.

No. 24. May 4, 1921.

"In reply to your circular letter of April 22nd, I would say that as a gas consultant of the 4th Army Corps in France for three months, and Chief of the Medical Service of the Gas Hospital at Toul for six weeks, I saw a great many gas cases and studied them from the clinical point of view, or until their evacuation to the rear. Later, in Philadelphia, I studied a good many ex-service men coming to our State Tuberculosis clinics and claiming disability due to the effect of gassing, particularly in relation to pulmonary conditions.

"As a result of this experience I can only say that I agree thoroughly with paragraphs A. and B. of your Circular letter; and would go even further and say that in my judgement, the principal after effects of this new and alarming weapon in warfare was a mental one and that without any pathological foundation which leads these men to attribute subsequent illness, and often any kind of illness, to previous gassing.

"I am further led to this view because in questioning closely many of these men in relation to the time and place to which they were evacuated I found that their statements, whether intentionally or not, were absolutely unfounded in that they had never been through the only gas hospital in that area. Many of them were among those who

were brought in to the forward field gas reception hospitals or triages, were kept under observation for twenty-four hours and returned to the lines; in other words, had never been gassed at all.

"The great majority of the cases passing through the gas hospital at Toul which evacuated from the St. Mihiel Sector were mild cases of mustard gas with superficial burns. The mortality was very light. I cannot speak from experience of the severer effects of gas during the earlier period of the war due to ineffective masks and poor gas discipline, but to which few of our troops were exposed. My experience only dates from the early part of August.

"In conclusion, I am inclined to feel that there are thus two elements in this problem, one neuresthenic, where the men have been really gassed, usually very slightly and believe sincerely that this is a factor in any present illness, and second a self-deceptive and often untruthful effort to attribute disability to this source.

"A. P. F." Director of Tuberculosis Div., Harrisburgh, Pa.

No. 25. May 5, 1921.

"Your circular letter of April 23rd, regarding the remote effects of gas poisoning, has been received. First, I will say that my early experience (professional) with early gas cases, was quite limited, as my service in France was practically all administrative. Any opinion I would express based upon that experience would be of little value. Since returning to civil life and following my specialty of nervous and mental diseases, I have examined a large number of discharged soldiers, some of whom were private cases, but the majority of them were war risk and Federal Board cases. These cases of course, are all referred to me on account of neuro-psychopathic disturbances, usually secondary to some exciting cause. All cases are given a careful physical examination and the majority of them have complete laboratory and X-Ray studies. The percentage of cases I see, with history of having been gassed, is comparatively small and I doubt if my conclusions will be of great value.

"In my experience, I am unable to see that gas poisoning has any specific effect on the central nervous system, or, in producing the so-called psyshoses or psycho-neurosis; except insofar as it acts as a mental shock in the same manner as injury or other serious physical ailment. The

mystery and subtility of chemical warfare would no doubt be more potent as an exciting factor in the production of of these disorders in men of potential mental instability, than would other, better forms of disability. Our ignorance of the remote effects of gas poisoning could well be used by the Malingerers, but in my experience, I have been suspicions of it in only one case. In fact, it has rather been the tendency for my cases to disregard gas poisoning, unless it was very severe.

"I see many cases of hyper-thyroidism, but it is impossible to connect them directly, with the effects of gas, other than as mentioned above.

"A large number of pulmonary and cardiac cases, with secondary neuro-psychopathic disturbances, in which it is supposed the primary disability was due to gas, are also seen; yet the nervous symptoms are no different from those seen in similar cases of other etiology.

"In conclusion I would say, that so far as I have been able to determine, gas poisoning has no specific effect on the central or sympathetic nervous system, acting only as an exciting cause as would any other serious illness or injury.

"L. D. C." Indianapolis, Ind.

No. 26. May 7, 1921.

"The immediate effects of gas warfare were observed by me in Dartford, England, U. S. Base Hospital, No. 37, where I had the opportunity of studying these cases. Since resuming private practice, the patients I have seen who have mentioned "gas poisoning" as the cause of their trouble have tended to confirm the conclusions of the Board at Fort Grant. I have seen some cases of bronchitis in patients who have given a history of gas poisoning - these patients seem more susceptible to attacks of bronchitis with the production of moderate quantities of mucus, frequently blood stained. Dyspnea is more marked in these cases than in the usual case of bronchitis. Physical prostration is more marked. The temperature while above normal is not high. The pulse is rapid, 120. No signs of pneumonia nor of pulmonary tuberculosis are present in theseccases.

"H. M. H." Brooklyn, N. Y.

No. 27. May 9, 1921.

"In reference to your circular letter of April 23rd, relative to the after effects of gases on the lungs. The

number of soldiers applying for compensation on a basis of having been gassed, attests to the fact that an undue number of tuberculous individuals were passed into the army by the examining boards. I think the standards for diagnosis of tuberculosis should be revised as far as it applies in army practice.

"Gas, no doubt, caused many quiescent pulmonary focus to become active. I disagree with the Medical Board of Fort Grant insofar as it applies to those who had a latent focus of tuberculosis in the lungs. Any lung inflammation in these cases, be it gas, pneumonia, or influenza, is liable to re-activate a quiescent focus.

"The Government is face to face with the fact that a large number of men were accepted for duty who should have been rejected. They became incapacitated in line of duty and now nothing remains to be done but take care of them and to guard against these mistakes in future emergencies.

"Your paragraph as to the metabolism, etc., would seem to offer no relief, even were these problems solved.

"The immediate effects of gas passed long ago. It is pulmonary tuberculosis, bronchitis, emphysema, chronic bronchitis that now concerns the Government. I believe a number of claimants untruthfully assert that they were gassed. Their service records surely would clear up the point as to whether they were ever in a gas attack. Those who apply for compensation a year after discharge claiming to have developed tuberculosis as a result of their army service certainly do not have much basis for such an assertion. They probably would have become tuberculosis patients even if they had never been in the army. If a year or so elapses from the time of the alleged gassing until symptoms of tuberculosis develop it would seem probable that gas had nothing to do with the question provided that soldier's lungs were clear at the time of discharge."

"G. A." Ashville, N. C.

No. 28. May 9, 1921.

"Have deferred answering your inquiry as to gas injuries during the war in order to refer to my private records made during that time, while in service in France where I had charge of the American Red Cross Hospital, No. 113, in Cognac. There we received several hundred men suffering from the results of "gassing" and am able to say that with the exception of the local destructive effects of the mustard gas on the skin or any part it touched, causing

ulceration, etc., there was no permanent ill effect on the respiratory tract of these patients. Of course, there was a great deal of irritation and cough which has persisted in some cases even to this day.

"It is my opinion that this persistence of cough is an established habit rather than from any lesion. I substantiate this belief by repeated examinations, especially by direct tracheoscopy, laryngoscopy, and bronchoscopy, as well as stereoscopic X-Ray examinations of the chest.

"As to tuberculosis following in the wake of gas, I have seen two cases wherein arrested processes were aggravated to acute fulminating tuberculosis. One man succumbed and on the postmortem showed destructive action around old cavities. The other man was a patient of mine before entering the service and had a healed out tuberculosis. When I saw him fourteen years later, having been gassed (phosgene) he had an acute pulmonary tuberculosis which, however, subsided so that he was able to be mustered out in fair condition."

"J. C. B." Chicago, Ill.

No. 29. May 10, 1921.

"I have received your letter in reference to the late effects of toxic gases. I have been especially interested in this subject because I performed a number of autopsies upon those who had died shortly after gassing. I have found very little in the literature concerning the later changes in the lung. I feel no doubt that the frequency of the later injurious effects has been greatly exaggerated. Nevertheless, the early changes are of such a character that in a small proportion of instances later chronic lesions of the lung might result. I am more inclined to this view because of a certain degree of similiarity between pulmonary lesions of influenza and those of gas poisoning, both being in large part the result of profound destructive injury of the mucous membrane of the bronchi. It seems to me probable that bronchiectasis and chronic fibroid lesions might follow gas poisoning as they follow influenza, though I have had no opportunity to obtain direct proof of this opinion. Doubtless, chronic bronchitis persists in some cases.

"Following influenzal pneumonia there is in some instances, unresolved broncho pneumonia occurring in small nodular patches. The diagnosis of tuberculosis has been not unfrequently made in these cases chiefly as the result of the X-Ray plate. I have examined a case of this chara-

cter at autopsy very recently. The possibility of this error should be considered I believe when tuberculosis appears to be a consequence of gas poisoning."

"E. L. O." St. Louis, Mo.

No. 30. May 11, 1921.

"Replying to your recent inquiry, I am pleased to report results in a series of examinations of ex-service men who were applicants for compensation for disability received in the military service.

Number	of men examined	172
"	giving history of having been gassed ..	37
"	Chronic bronchitis	6
"	Pulmonary tuberculosis	1
"	Negative pulmonary findings	31
"	Cardiac arrythmias	12
"	Goiter	8
"	Epileptiform convulsions	1
"	Aphonia, recovered	1

"I have not found in these cases, evidence of material destruction of lung tissue, and to date there is no evidence of marked pre-disposition toward pulmonary tuberculosis.

"The functional circulatory neurosis have been more prominent. They seem to have been caused or aggravated in men with neurotic tendencies and in general are not permanent."

"C. H. B." Sparta, Wisconsin.

No. 31. May 13, 1921.

"In reply to request for an opinion on the after effects of gas poisoning, I shall be brief because of not having come in contact with any great number of these cases since leaving the army service. I don't think physicians in their general routine of work do see many cases, as the number of those gassed and not having become permanently well are not large in any single community, and most of those seriously afflicted are receiving treatment at Government Hospitals.

"With regard to the Bureau granting disability pensions and having to determine who is and is not eligible for compensation, is a very tedious and difficult task and this Board has the sympathy of most doctors.

"Having served 14 months as U. S. Medical Officer attached to a British Expeditionary Force in Flanders and constantly at the front where gas in varying quantities and composition was always present in the air and permeating the soil, I was able to observe it in nearly all its aspects from the time of contact with the individual until that patient's death or watching his evacuation through the Divisional Medical Stations, until it was decided that the patient would not be able to resume duties for an indefinite period of time, when he would be removed to the Corps hospital.

"The degree of gas poisoning varied in each individual case, some of the milder cases reporting to regimental aid posts in which it was extremely difficult to make a diagnosis of gas poisoning at the time, and others who were in such bad general condition they died within the first 24 hours in great agony.

"From my own observation, I am convinced that the great majority of cases suffer no after effects of gas poisoning, especially those, who in most cases, received only a mild gassing or those who were less fortunate but who were in the best of health with no inherited weakness of the organs affected by the gas. Others I am certain may suffer directly and permanently from the effects of the gas, or it may predispose to other conditions as, for example, tuberculosis in the lungs, etc., since in the lungs in phosgene poisoning we have found intense congestion, thrombosis of capillary and pulmonary vessels.

"Conclusions drawn are that it is impossible to tell in all cases of primary gas poisoning and later developing secondary conditions whether or not gas predisposes to secondary condition."

"C. C. C." Greensburg, Pa.

No. 32. May 14, 1921.

"Replying to your letter of April 23rd asking for data on the effects of gas on patients, I can say that the experience I had was at Army General Hospital No. 3, Rahway, N. J., as Chief of the Medical Service. Here we received quite a number of patients who had been gassed. In not one of them did we find evidence of pulmonary tuberculosis. The effects we noticed were a chronic cough, some shortness of breath on exertion, a lessened expansion of the chest, usually about an inch under normal expansion and on X-Ray examination a considerable peribronchial infiltration.

"We noticed no special effects on the gastrointestinal tract or upon metabolism."

"S. R. S." Chicago, Ill.

No. 33. May 16, 1921.

"I agree with A and B report of Board at Fort Grant. I have seen, as consultant in internal medicine to Base Hospitals in the Southwestern states, many X-Ray plates of gassed men. They almost invariably show heavy perobronchial shadows. Certain of these men, perhaps not over 2 to 4% have chronic bronchitis, and some asthmatic wheezing even now, two and a half years after gassing. I think these few are permanently injured. If no definite physical signs exist, the nutrition is good, I believe they are not permanently damaged. I have no knowledge of any late effects on metabolism, chemical reaction of the blood, or on the digestive system. I have seen similar results left in firemen and others who have been exposed to chlorine gas nitrogen pentoxide, etc. Certainly most of the gassed men in my experience have fully recovered."

"J. N. H." Denver, Colo.

No. 34. May 20, 1921.

"In reply to your circular letter in regards to the effects of gas, I would state that during my service in the Army I was stationed at Army Hospital #16, New Haven, Connecticut, which was entirely a lung hospital and that it was my belief, which was the one held generally that the effect of gas did not reactivate healed or quiescent pulmonary lesions.

"We did see some soldiers who presented evidence of pulmonary conditions who gave a history of rather severe gassing but these lesions were not tubercular in character, were entirely at the base of the lungs and, of course, might have been due to old pleurisy or bronchitis and not at all due to gassing. It was also our general observation that cases that had been gassed presented many neurotic symptoms for which physical examination did not show adequate cause. Although I can not produce absolute figures, I do not believe that gassing hadany effect in producing the cases of pulmonary tuberculosis that were observed in Army Hospital, No. 16."

"D. B. J." Rochester, N. Y.

No. 35. May 27, 1921.

"My service before the Armistice was with the C. W. S., A. E. F., as pathologist and after the Armistice my station was at the Laboratory Headquarters for five months. This period of time immediately following the cessation of war activities I consider the most important one for individuals who had really suffered an important injury from war gas poisoning and naturally my interest was centered on all autopsy protocols received at this station which contained a former history of gassing.

"The vast amount of press attention given to gas warfare both before and after our entrance into the war, as well as the fact that it was a new weapon, lent a romance to this feature that has never been associated with any former weapon. It is not surprising that many individuals through ignorance or intention will incorrectly associate many lesions and symptoms with a former history of gassing. There is no doubt but that it will be woefully overestimated in its importance.

"Our hope for an opportunity to study the organs of individuals dying at different periods of time following gas exposures could not be fulfilled save for a few instances. We did cause circular letter 156 to be sent out from the office of the Surgeon General to be published in the medical journals. In the future the Army Medical Museum may receive enough such material to form some opinions.

"I cannot as a pathologist discuss the subject of metabolism and alteration in the functions of the stomach, intestines and blood. The few individuals whom I have known that had what they called "stomach and bowel trouble" were those who had been subjected to rather severe exposures of the suffocative type of gases.

"To my mind there are three points which are usually overlooked by those who claim permanent disability from gassing and by their medical advisers.

(1) The period of time from 1917 to date offers ample opportunity for the onset of a disease totally unassociated with war wounds and war exposures. Enough time has also passed for a latent or chronic disease to make itself known.

(2) Undoubtedly many soldiers entered the war with small latent foci of tuberculosis that could not be determined by an recruiting staff at the time they were taken into the service. A few

No. 33. [illegible] 27 [illegible] 21.

"[illegible] Dr. [illegible] professor [illegible] laboratory [illegible] I consider [illegible] really gotten [illegible] structures [illegible] has received [illegible]

"[illegible] larger numbers. [illegible] that [illegible] applica-ble through [illegible] of [illegible] but that it [illegible] fully [illegible]

"Our [illegible] of [illegible] pre-sence. [illegible] in the medical journals. In the future [illegible] Baker: [illegible] receive [illegible] opinions.

"[illegible] in the [illegible] blood. [illegible]

"[illegible] unusually [illegible]

(1) [illegible] unusually [illegible]

(2) [illegible]

years of time would find these lesions further advanced regardless of any war experience.

(3) Epidemic respiratory disease was prevalent during our participation in the fighting period (gas danger period) and, therefore, it is impossible in most cases to know which of these features was the more important in producing late disability.

"The overseas Laboratory Headquarters did notice a slight increase in the number of cases of tuberculosis reported at autopsy during the five months following the Armistice. This may indicate a true-increase in the rate of this disease due to latent foci being fanned into activity by gas exposures or acute respiratory disease. On the other hand, two years had passed since induction into the service and that much time would allow many latent cases to become active and to disseminate. Another thing must be kept in mind, more autopsies were conducted during this period of time in relation to the death rate than was the case before the Armistice. Close confinement in village quarters over long periods of time following the Armistice may also have given the men an opportunity to contract the disease in quarters since it is said to have been quite prevalent in those villages.

"The true effects of war gas on latent diseases and their ability to produce permanent disability can be learned only by the continued collection of clinical and pathological data over a long period of time by members of the profession qualified to make such observations. In my opinion, the general rule is complete recovery from gas poisoning of the various types. Cases in which a severe infection gains a foot hold are open to the various sequelae that may follow any acute respiratory disease.

"Since the vast majority of our gas casualties were due to mustard gas, it seems within the realms of possibility that a few cases might be encountered showing a typical regeneration of the epithelium in the upper respiratory tract, peribronchal fibrosis, interstitial fibrosis, chronic bronchiectasis, aphonia, poor vision, emphysema, etc.. There is no reason to believe that there is a greater percentage of disability in gas poisoning than is the case with diphtheria or an acute respiratory disease of ordinary type.

"Popular opinion will be hard to educate to this view because of the romance thrown about gas warfare and their ignorance of the type and degree of most of our gas

casualties. The influence of the aggressive efforts on the part of a few will intentionally present the wrong phase of the subject in regard to their disabilities will also have its effect.

"It is my belief that the prospect of exciting a latent tuberculosis into an active tuberculosis is the greatest harmful result that might be encountered but, even in this, one must remember that the natural effect that has passed since induction into service and the number of "colds" contracted will play a very important role in exciting latent tuberculosis. Indeed, cases that are developing at this date (1921) are certainly open to many other thoughts before associating it with wargas injuries sustained in 1917 and 1918.

"Since war gas was a weapon introduced as a surprise by the enemy and was known to be against the established military rules of warfare it has a very unsavory reputation and this has been given wide publicity. Public opinion has naturally been carried along this channel of thought. Its results have been greatly exaggerated and the stage is set to credit this subject with dire results that have formerly surrounded the old subject of "shell shock".

"Continued trained and unbiased observation is needed to learn the actual incidence of the harmful results that may accrue from the use of this weapon and to dissipate the ignorance and mystery which surround the subject of war gas poisoning. I believe that the final answer will be that war gases are more humane than the bullet or shell insofar as future handicaps to the soldiers are concerned."

"H. C. C." Ancon, Panama.

No. 36. April 26, 1921.

"Your letter regarding the effects of gas in relation to chronic pulmonary and other diseases was received this morning.

"It would be difficult to convince anyone who had seen the immediate effects of phosgene and mustard gas on the lungs and upper air passages, that such a severe irritation of the mucous membrane would not in many instances leave permanent results. I remember in 1917 on the British Front near Ypres, seeing about 1200 gas cases in one day. This, I think, was the first time mustard gas had been used. The death rate was very high, and I saw the results of two autopsies in which there was a complete gangrene of the

mucous membrane of the trachea down to the smallest subdivision of the bronchi that could be detected with the naked eye, together with a very extensive bronchopneumonia.

"While cases that recovered have nothing like the destruction of tissue of fatal cases, one would not like to say that a person who had approaching this might not have some permanent disability, and if it occurred in a case of incipient or quiescent tuberculosis, it would be a courageous medical man who would be willing to state that no harm was produced. On the other hand, I heard from many reliable British sources that the total number of cases showing the after effects of this gas, was comparatively small, and those following phosgene even smaller, which would indicate that those having the severe lesions eventually died and were not inmates of convalescent hospitals.

"As I have had no special experience in gas cases, I have taken no particular paines to inquire as to the end results. I am stating the above simply for the reason that I think the pendulum is swinging too far, and that we are inclined to disregard, in many instances, the late symptoms (difficult to prove) of those who have suffered from the effects of these gases.

"My own opinion is, that in order to obtain accurate data, a commission should be appointed to undertake a series of experiments in which various types of animals would be exposed to these gases in different concentrations and for different periods of time. In this way one could get specimens of lung tissue, from those cases which were rapidly fatal all the way through the series to those cases which were only embarrassed for a short time. These organs could then be studied carefully by some expert pathologist, and we might then gain a fairly accurate idea of the actual changes which take place in the human being. It is quite possible that this has already been done, but if not, I think it would be well worth while to consider it, as I can easily see that the Department of Pensions must have a very difficult problem on their hands, and we will all agree that everything possible must be done not to do these cases an injustice."

"G. E. B." New York.

No. 37. April 27, 1921.

In reply to your circular letter of April 23rd, had my experience been limited to that of the War and of immediate contact with troops after the Armistice, I should

have been quite willing to have subscribed to the conclusions of the Board of Medical Officers quoted. During the past year, however, I have seen many returned soldiers, many of whom are bona fide cases of gassing and a considerable number among our own fraternity; there is a comparatively large number of cases of pulmonary tuberculosis developing among these people and a number of instances of chronic bronchitis is so great and the persistance of the bronchitis so typical that I think that we must attribute the disease to large extent to the former gassing.

"Thus far, I have seen no effect on any of the tissues other than the respiratory system, a chronic naso-pharyngitis should perhaps be included with the chronic bronchitis and the tendency to enlighten up acute tuberculosis.

"I am very much interested in the work of the American Legion dealing with the discharged soldiers and I find that my conclusions corroborate those of many of my colleagues who are similarly engaged and interested. I want to specially state that I have seen no gastro-intestinal lesions or symptom groups probably due to a previous gassing."

"H. B." New York City.

No. 38. April 29, 1921.

"In reply to your letter of April 23rd, I beg to state that I have talked the matter over with Dr. B.L.C. who had charge of some of the laboratory work at the hospital centre at Allery, France and performed quite a number of autopsies on gassed soldiers. My own experience in France, - I have had none in this country, - is based upon the examination of a small number of soldiers dying as the result of gassing or from other causes. Some of the autopsies were held by assistants, others in Base Hospital No. 38, still others at the hospital centre in Beaune, France. Unfortunately my personal records of postmortems in France have been lost; consequently what I write is from memory.

"There can be no doubt in my mind that permanent changes occur in some of the more severely gassed individuals. I have seen alterations in the trachea and large bronchi which surely could not have repaired without leaving some structural change. The extensive interstitial and vesicular infiltration seen in some of these cases must also have greatly disturbed pulmonary function, if not permanently damaged it. One cannot be so sure of the per-

[illegible]

[illegible]

"[illegible]

"I am [illegible]

[illegible]

"In reply to your letter of [illegible]

[illegible]

"I [illegible]

manency of such alterations, particularly when one recalls that in croupous pneumonia and in the pneumonias of measles and other infectious diseases, there may be extensive changes which we have reason to believe do not permanently alter the organs, or in many cases at least give rise to symptoms which in later years are clearly attributable to antecedent pneumonias.

"Of course, some of the severely gassed patients will show renal change, and no doubt, although with regard to this I have no evidence,- cardiovascular alteration. I do not recall an instance in which it is perfectly clear that the associated nephritis was due to gassing, possibly to subsequent or concurrent infection.

"I infer that you do not care for any expression of opinion upon the published studies by English, French, and German observers, or the experimental work by Warthin and others. So far as I know no case has come to autopsy here or in my service at the City Hospital, in which we had reason to suspect that the antecedent change was due to gassing."

"W. L. C." Philadelphia.

No. 39. April 29, 1921.

"In reply to the queries contained in your letter of April 23rd:

With regard to the effect of gas upon the lungs, my experience has been, so far as my observation in a limited number of cases is concerned, that a certain form of lung condition, which is the after effect of gassing, is rather in the nature of a fibrosis with increase in the infiltration of the fibrous tissue around the bronchi and capillary bronchi. This is evidenced by clinical and Roentgen examinations. I believe that this type of lung infiltration has quite frequently been mistaken for tuberculosis.

"I have no data available as to the later effects of gas on metabolism, or the effect on the chemical reaction of the blood with reference to its acidity.

"With regard to the stomach and intestines, I believe that there is a definite traceable effect on the mucous membrane of the stomach and duodeum, which may be manifest through certain functional stomach tests, or in the form of ulcer of the stomach or the duodeum.

"I believe that some of the cases examined also show a definite traceable effect from the gassing upon the heart

muscle, which is evidenced by myocardial degenerative changes. I have not seen enough of these cases clinically to form a definite opinion with regard to the etiology and can only give my observations so far as my experience has gone. I think that more attention should be paid to the circulatory apparatus following out this thought, as not infrequently certain forms of so-called bronchitis and lung conditions are directly referable to heart muscle insufficiency; and where the lung symptoms over-shadow the heart, the latter condition is quite likely to be overlooked. It is, therefore, of great importance to pay special attention to the nature and character of the heart muscle and the muscle tones rather than to look for valvular conditions, and where there is an absence of murmurs, consider the heart uninvolved."

"H. H. L." Los Angeles, Calif.

No. 40. April 30, 1921.

"It is my belief that patients who have been gassed bear ether anaesthesia badly. Severe bronchial irritation has resulted in two cases when this had been administered."

"L. F. C." Minneapolis.

No. 41. May 2, 1921.

"My observation has been that men who report that they were gassed at any time complain of a cough, some soreness through the chest and almost always of shortness of breath. In very few cases have I been able to determine by the findings of rales, or any other physical symptoms and evidence of bronchitis.

"From my observation as Public Health Examiner and as Chief of Medical Service at Camp Dodge, where we received a considerable number of cases that had been gassed, I believe that some of the deleterious effects of the gas was due to myocardial changes, basing this largely on the shortness of breath."

"E. T. E." Ottumwa, Iowa.

No. 42. May 2, 1921.

"Your questionnaire dated April 23rd has been received. I have had no recent experience with the results of gassing. But from what I saw in convalescent cases I feel I am justified in this opinion."

"The burns and necroses such as I saw in the nose, pharynx, larynx and trachea of the convalescents would, in some cases, probably extend into the bronchi. After convalescence, the cicatricial areas in the bronchi would render these cases less able than normal individuals to resist bronchial infection and inflammation of every kind."

"W. S. B." New York.

No. 43. May 21, 1921.

"I beg to acknowledge your communication under date of April 23, 1921, relative to permanent disability resulting from the effects of being "gassed". From personal experience my opportunities of seeing victims of gas have been few, living as I do at this remote outpost of the United States, and not having been fontunate enough to have gotten duty overseas, have not come in contact with this class of men.

"I see an occasional case in private practice of men who have claimed to have been gassed, and in some instances have found considerable bronchial disturbances. I have not had an opportunity to follow up the patients later, so any information I could give would be valueless."

"C. B. C." Honolulu, T. H.

No. 44. June 13, 1921.

"In my work at the Johns Hopkins Hospital, I have not come across an instance of illness which it seems to me could reasonably be traced to gassing. I have seen a few individuals of the psycho-neurotic type who are inclined to regard themselves as having been gassed, but I have no good record of this. I have been surprised that so few instances of pulmonary or bronchial involvement have turned up. I realize that any opinion I may have is based on insufficient evidence; nevertheless, I have the very distinct impression that at the present moment the instances in which there is evidence of disability dependent on permanent organic change are very few."

"W. S. T." Baltimore, Md.

No. 45. May 6, 1921.

"In reply to yours of April 25th, my service following the signing of the Armistice did not bring me in contact with many service men;I was assigned to Fort Sill, Okla., where we had so very few referred cases that I did not have enough so I feel I am warranted in expressing an opinion.

"I am inclined to believe that the men are giving too much prominence to the possibility of permanent bad results from being "gassed" due possibly to a very nervous condition rather than any existing real pathology."

"F. H. C." Oklahoma City, Okla.

No. 46. May 5, 1921.

"I have received your letter of April 25th regarding gas cases of the late war. It might be of interest to you to know that I was commanding a Sanitary Train composed mostly of men in California. Several of these were gassed in action and I have had the opportunity of examining them since their return inasmuch as I am a Designated Examiner of the U. S. P.H. I kept no data on these cases outside of that required in the Public Health Service and as these cases are all forwarded by me, they are not at hand at present. My conclusions based upon recollection only is that I do not concur with paragraph A in regard to showing no marked predisposition toward pulmonary tuberculosis. I do agree with paragraph B that gas victims presented little evidence of immediate destruction of lung tissue. However, the fact of their having been gassed devitalized without destruction lung tissue to such an extent that a fair sized percentage of the present cases of tuberculosis showing up in a period of time varying from six to eighteen months are directly traceable to the effects of their gassing.

"There are two other phases of this poisoning which have been brought to my attention which I think are directly traceable to the effects of phosgene, namely, tubercular laryngitis and tubercular glands of the throat (understand I do not mean glands of the neck). I have had presented to me three different cases showing marked enlargement of the lymphatics surrounding the larynx which have been increased in size to such an extent that breathing was carried on with difficulty. In one case intubation was necessary. In one of these cases death occurred from suffocation. The other two cases passed out of my control to a Government Hospital and I am unable to say what the ultimate outcome was. Before losingg one of these cases, however, I was able to demonstrate tubercular bacillus taken directly from one of the enlarged glands. I have tried repeatedly to get data on these cases but have found none. The history in all three cases was practically the same, exposure to phosgene with no apparent detrimental effect excepting a slight tightening of the throat muscles at the time and a marked irritation of the air passages. In regard to the tubercular laryngitis without tuberculosis of the lungs, I have seen

I think something like ten cases, all carrying practically the same history as the above mentioned cases.

"As I have mentioned above, this is from recollection only, yet I hope it may prove of some value to you. I would be very much pleased to know of further findings along these lines with treatment for the same if available as I am daily coming in contact with a large number of Federal Board Trainees."

"S. F. B." Oakland, Calif.

No. 47. May 1921.

"I desire to state from conclusions drawn after seeing gassed cases during the war in Europe in 1916 and later in America after the war when I was the local examiner here in this city for the Federal Board, W. R. I., up to the time that it was placed in the hands of the U. S. P. H. S., that gassed cases were looked upon by me as affected in the lungs primarily by gross organic pathology. The same in adjacent organs directly affected such as the trachea, larynx, pharynx, ears, the nervous system, heart, stomach, etc., indirectly only secondary to functional disturbances due to lungs or respiratory pathology and as to psycho-neurosis as to be of no moment.

"Many of these cases I hear from at intervals confirm me in my original deductions that tuberculosis is a small factor in the end results of those men who were gassed in the war. In fact I have endeavored to follow up individuals whom I pronounced non-tubercular on close physical examination, yet were later sent to tuberculosis sanitariums for observation with doubtful or negative diagnosis were later discharged as non-tubercular. Gassed non-tubercular individuals will likely remain so. Tuberculous individuals will fall ready victims to disease owing to their lack of immunity."

"C. S. L." Milwaukee, Wis.

No. 48. June 1, 1921.

"Your letter of April 25, 1921, regarding gas victims, was received by me recently.

"I am sorry that I am not in a position to furnish you any information regarding gas victims as I have had no follow up experience since leaving the A. E. F. All I can say is that the cases I see, non-professionally, in

this part of the country, show that they are improving and, in some cases, rapidly approaching normal condition. From the meagre knowledge that I have, the gas victims present little evidence of material destruction of lung tissue but, in this climate, they seem to gain rapidly. Nearly every man that I have spoken to who has been gassed refers to himself as tubercular, which I am not in a position to verify or deny.

"I believe a great many are drawing compensation from the Government, who have been gassed, who really are not entitled to that compensation, and it is a question that the Public Health Service can best determine by frequent examinations and reports to your bureau."

"H. R. B." Santa Fe., N. M.

No. 49. June 10, 1921.

"Some days ago I received a letter from you in regard to my opinion of the use of toxic gases in the World War.

"It is my opinion based upon the examination and observation of men returning from overseas who had been gassed that it did not necessarily follow that, because of the fact there should remain any permanent ill effects after recovery.

"Undoubtedly many of the reenactivated cases of pulmonary tuberculosis returned to this country were aggravated to a degree by exposure to gas, but that alone could not be considered as the only factor in reenactivation, as many of these cases gave a complete history of exposure (prolonged) loss of sleep and food which over a long period of time certainly would tend to break down constitutional resistance.

"In no cases of gassing which I examined after recovery did I find any destruction of lung tissue, except in cases of reenactivated pulmonary tuberculosis. Lung changes were noted in some of the cases which had not yet recovered such as a sub acute bronchitis and emphysema of the lung with a history of repeated asthmatic attacks. Unfortunately, I was not able to observe these cases longer than a year after exposure.

"I believe there is a disability of permanent effect to the lungs, or other tissues of the body or blood after recovery from the use of warfare gasses, in other words, I believe that the results are immediate and unless there is pneumonia bronchitis, tuberculosis or some other immediate evidences of the exposure, the permanent impairment would amount to nothing and not constitute in any way a future disability.

During my war experience I was not able to follow up or make a study of the effects of gas on metabolism, functional disturbances; effects on the digestive system, except indirectly as affected by other diseased conditions. I do not believe that conditions of the lung produced by gas varies materially from those produced by other causes, except in the quick effect of the gases.

In my work as Commanding Officer of General Hospital No. 18 where many of the first gas cases were returned for treatment for tuberculosis, they found that a very large percentage were suffering from Bronchitis or other lung conditions which might have been due to other exposures and in many cases seemed worse than those who had been exposed to gas.

Based upon these observations it is my opinion, that a very large proportion of gas cases can and do make complete recovery without any objective or physical signs of any impairment of lung usefulness or other functional disturbances, and that the claims of applicants for disability pension on account of after effects of warfare gases are very much exaggerated.

C.E.D., Albany, N.Y.

No. 50, June 17th, 1921.

In reply to your inquiry as to the after effects of toxic gases in warfare, I have the honour to submit the following opinions and observations, which you are at liberty to publish:

1. Men overwhelmed by war gases died on the field of within a few days.

2. Soldiers who merely perceived the odor of gas in dugouts, shell holes and wet places have no right to claim that they were gassed.

3. Among survivors, probably only a small number of cases had their true lung tissues affected. Local effects were expended on the upper air passages.

4. I do not believe that gassing left any late results on metabolism, or permanent changes in reaction and composition of the blood.

5. The debility of most of these so called gas cases is due to the general condition of Neuro-Circulatory Asthenia (Exhaustion, Fatigue du Service) and not due to gas.

In my opinion, much of the bronchitis and Asthenia afflicting so many of our soldiers and ex-service men is due to the excessive inhalation of cigarette smoke.

Pulmonary Tuberculosis in soldiers was induced or favored by the general lowering of vitality, and only a few cases can be ascribed to gas alone. In many cases, however, reactivation of quiescent Tuberculosis can be charged to gas as an exciting cause.

C. L. G. A. Washington,D.C.

No. 51, June 28th, 1921.

In reply to yours of June 30th, I wish to state that the observations of the physicians of this county tends to confirm the findings of the Board of Medical Officers of 1919 at Fort Grant as reported in your letter.

I have had an ex-soldier under treatment for two years who says he was gassed and spent a term in hospital in France. He is pale, languid and seems unable to do a full man's work. Complains a great deal of pain in the chest and some dyspnoea. However, when he is clear of colds, physical examinations of chest is negative; he has twice been examined by the Medical Board but they had disallowed his claim for compensation.

K.S.H., Franklin, Tenn.

No. 52. July 15, 1921.

Your favor of June 30th, 1921, relative to the effects of warfare gases(chemical) upon the respiratory tract, has been received and I have filled out the blank as best I could in line with your inquiry. I trust that the information furnished may be of service to you. My physical findings were checked up with clinical observation, X-ray reports and in many cases a positive sputum.

My experience with the cases who were gassed severe enough to call for hospitalization at the time of being gassed are the ones that have developed tuberculosis at this time, as a rule. Time alone will tell what will happen to those men who were made sick, vomited and otherwise made sick but did not enter hospital for the trouble. Many of the latter cases now have peribronchal infiltration as evidenced by physical examination and X-ray findings. My experience with the severe Flu cases who were left with a marked peribronchal infiltration is that they are developing pulmonary tuberculosis. In my opinion, all gassed cases should be watched carefully for the next three years.

C.F.S., Goldsborough, N.C.

No. 53, July 15,1921.

I do not feel that I am in a position to fill out in detail the enclosed questionnaire. I do, however, have quite a number of cases, which I see in my neurological practice, which give a history of having been gassed in the Service. In a very few, there has been some question as to whether their dyspnea and general

fatigability were due to inhalations of noxous gases. I do not recall a single instance in which I have seen enough pathology, on medical examination, to explain these symptoms. It has been my practice, therefore, to go on the assumption that the fright and other incidences at the time of accidents were sufficient to produce a residual neurosis. This condition has been borne out too often to be merely a coincidence. I have seen everything from a dementia praecox to a definite alcoholic neuritis blamed on gas. In the Pittsburgh region, we frequently see individuals who have poisonous gases, and only from Carbon monoxide have I seen a residual organic lesions in nervous system. I do not recall any lung or heart condition, which could be attributed to this.

Probably I feel a little too keenly about this, but the attempt on the part of a number of constitutional inferiors to abuse our pension system through any means, among these gas, has influenced and molded my opinion.

W. H. M., Pittsburgh, Pa.

No. 54, July 16, 1921.

I have your request for findings in cases of men who were gassed in the late war and summarize them as follows: I have examined fifteen men who claimed to have been gassed, all for the Bureau of War Risk Insurance.

Several said they had been gassed with mustard gas but only one man had any scars resulting from it, these were rather superficial but rather deeply pigmented brown. One man who claimed mustard gas had well marked signs of pulmonary tuberculosis. It is possible that he was gassed with phosgene as he had no scars from mustard gas burns. Seven men who claimed to have been gassed with phosgene presented no physical signs of any pulmonary troubles but did present neurotic complaints of various sorts. Five of these were considered to over-emphasize their troubles for the purpose of getting compensation as they had been working regularly and had lost no time from their work on account of the trouble. There was an element of superstition in these men also which made it difficult to properly classify them as they were all rather uneducated and had evidently picked up many statements regarding the effects of gas; in some cases applied them quite inappropriately.

"Seven men complained of breathlessness on exertion and in every case there was also an increase in the pulse rate after exercise. One man complained of pain in the region of the heart and six of pains; indefinite and not sharply defined in the chest. Three men had cough, two of these tuberculosis cases; and these men also had loss of weight. Three men had more or less well marked gastric disturbances which persisted from the time of the onset of the trouble. One man a husky voice which he claimed was a residual of the gas. Three men who had been gassed with phosgene had well marked pulmonary tuberculosis, in addition to the man who claimed to have been gassed with phosgene

"From these few cases one may not draw any very definite conclusions but it seems apparent that pulmonary tuberculosis may follow gassing with phosgene and that the mental effect is very great in all classes but persists in the uneducated."

"C. R." Fairfield, Iowa.

No. 55. July 21, 1921.

"It is with pleasure I give you my observations in brief of gas patients.

"My observations were made while serving as Chief Medical Officer, Base Hospital, Camp Custer, Michigan, and Chief of Medical Service General Hospital No. 3, Colonia, N. J., also examinations made for the U. S. P. H. S. since my discharge.

"There is a difference in the amount of gas inhaled just as there is a difference in the degree of burn a man might have. The most usual symptoms were cough, dyspnea, tremor, tachycardia pain with feeling of tightness in the chest, sweating and asthma. These were usual symptoms with very few if any changes detectable in the lungs. It was found that gas might effect any organ though with what permanent results am not able to say as have no opportunity to follow except three or four cases. Some cases I saw had a gastritis due probably to swallowing gas. It might be interesting to note observations on the stomach that were affected and that may give some insight in the way it affects the lungs. These cases vomited their meals, had very little if any pain or uneasiness and were able to only digest liquids. Fractional stomach analysis were done on a number of these cases with the results that the amount of H Cl was normal, the total acidity was normal, no blood or pus was found.

"Some cases showed a moderately high acidity but they were not the severe cases and only what you would expect to find in running a series of normal cases. Conclusions were that the muscle tone of the stomach walls was affected. There was very

little physical change in the stomach just as there is very little change detectable in the lungs. Many cases had much the appearance of what was known as neuro-asthenia. Nervous symptoms in all cases were marked showing involvement of the central nervous system.

"It is believed by me that gas affects the tissue of parts by destroying it, that the effect like a burn that this tissue heals leaving a scar tissue in delicate parts which may break down or at least furnish an area which is susceptible to infection."

"B. F. M." Montgomery City, Mo.

No. 56. June 28, 1921.

"Referring to recent inquiries regarding the after effects of warfare gases, I hereby state, that I have examined 73 ex-service men from April 1920 to July 1921; reexamined on an average of every two months during said period.

26 men gave histories of having been gassed.
39 men of total were diagnosed as suffering with tuberculosis.

"Of the 39 cases of tuberculosis, 9 gave histories of having been gassed; while 8 gave a family history of tuberculosis, or lung infection in family while the remainder of the 73 men were diagnosed as suffering with the following conditions: heart disease of different types and undiagnosed, asthma, acute bronchitis, chronic bronchitis.

"During 1920 the gassed cases complained of sub-sternal pain and heavy feeling over the heart, but during the past six months the same patients have only complained of weakness.

"I have not done any blood or special work on the gassed men.

"Conclusion: Gas has no more tendency to activate latent tuberculosis than other causes.".

"W. H. Y." Hagerstown, Pa.

No. 57. August 5, 1921.

"Sometime ago I received a communication from your office requesting opinion on post gas cases. My experience is extremely limited as I do only operative surgery. However, my experience back of Chateau Thierry would cause me to suggest the

possibility of a fake in many many cases. Hundreds of these men were no more gassed than I was and yet all received a wound stripe and now are attempting to get all they can. I am not attempting to belittle the fellow who was really gassed but the fake and they are numerous.

"My observations with the British and here would have one to infer that men who recovered quickly had no after effects worth mentioning. However, severe cases when the mucous membrane was permanently damaged it seems to me the possibility of permanent defect and even T. B. might result. But cases recovering quickly with apparent early recovery should not blame the gas for everything happening thereafter. As you know the order was given when a man said he was gassed - send him back,- and I am sure many took advantage of this condition."

"D. McR." Council Bluffs, Iowa.

No. 58. August 6, 1921.

"Your letter of the 30th of June, referring to the possible after effects of gas used in warfare, was presented to the last meeting of the Grayson County Medical Association, favorably commented upon, and the blanks handed to the members who had seen service.

"What you don't know about gas, you will find out when men begin to apply for pensions. We used to have a doctor here who gave an ex-soldier a certificate to the effect that he had been suffering with chronic diarrhoea since the Civil War. When asked how long he had known that man, he owned up that he had never seen him until he got the $2 fee. How dould you then certify to his disease? "By his pulse man; by his pulse".

"So you will find them by the hundreds in the hereafter, who can certify to the effects of gassing by the pulse!"

"A. W. A." Denison, Texas.

No. 59. August 13, 1921.

"In reference to your letter in the Journal, August 6th, containing the questionnaire pertaining to the after effects of warfare gases, I wish to state that I have watched these cases for the past year but have not found any connection between tuberculosis, asthma, and chronic bronchitis but a number of cases showing functional cardiac disease, there has existed in my mind a reasonable doubt as to gas being the etio-logical factor. We have had a number of cases come through our office who have stated they have been gassed but upon close examination of the chest no lesions were found in the lungs or bronchi. In other words, the results of our examinations are practically the same as those found by the Fort Grant Board in 1919.

This is not the type of report that you desire but it will tend to show you that the conditions resulting from gas, in our opinion, does not produce tubercular conditions.

We will in the future give these cases more minute attention along the lines you have requested in your letter to the journal and will make a report of our findings.

H. D. S. Tampa, Fla.

No. 60, Aug. 15,1921.

Your letter to Dr. R. was read before the Medical Society here at our last meeting and it immediately called to memory a little village in the Lorraine Sector occupied by a battalion of the 167th Infantry, 42nd Division.

I was coming out of the trenches one day when the Boche put over some Mustard gas on a battery of our Field Artillery 149th, I think. I went to their relief, evacuated thirty cases, and you afterwards sent for me to question me about the attack, effects of the gas, etc., when you were sent there from General Headquarters.

You will recall that the largest projector gas(phosgene) attack of the war was put over on the "Forty Second" in the morning of May 27th, 1918. I attended the first Corps School at Gendrecourt, and in the A.E.F. Gas School at Chaumont. I have seen many gassed cases, and at present I am medical officer for the vocational school here Pascagoula, Mississippi, for ex-service men (over 460 men).

When serving with the A.E.F., many post gas cases were sent to me for return to their combat organizations while I was surgeon for the First Army Replacement Depot, and I found that a large percentage of the cases were not able to return to full duty. These men mentioned above walked about 3 Kilometers from the railhead to this camp, (1st Army replacement depot) and on arrival many of them were immediately admitted to the Depot Infirmary. As I remember the symptoms were dyspnea, pains in the chest and cough(very persistent), there was tachycardia and in some cases cyanosis. These men had been in the hospitals from six weeks to three months. I saw 467(think this correct) of these gassed cases while there. You will understand that the gassing in all of these cases had been severe enough for these men to be hospitalized in Base Hospitals for an extended period.

I have examined many ex-service men, and of these quite an appreciable number were so-called gas cases. In no instance have I been able by physical findings to definitely state that the men had been gassed. Unfortunately, I have been unable to do autopsies on any gas cases among the ex-service men.

I agree entirely with the conclusions of the Board of Medical Officers of the Army from Fort Grant.

With reference to the statement that ex-service men are breaking down at an alarming rate from tuberculosis and lung troubles, I have the following to say: It is my firm belief that many of the men who have been diagnosed as Pulmonary Tuberculosis in its various stages are not suffering from Pulmonary Tuberculosis at all.

This has been clearly demonstrated to me in this District, Alabama, Mississippi, and Louisiana. If this is true in this District, it is probably true in others. Many or a large percentage of these cases are examined by "Local Examiners" and others who are not capable of making accurate diagnoses. I think the Medical Problem of the ex-service man is not so much one of pulmonary tuberculosis as it is a neuro-psychiatric problem. This is my reaction after a careful study of the cases here, and in my examination of ex-service men. A large percentage of pulmonary tuberculosis cases here have been definitely proven not to be tuberculosis cases at all, but cases of psycho-neurosis.

I.K.

No. 61, August, 1921.

The greatest evil after effect, in point of numbers, in this climate at this time is the asthma-emphysema syndrome. As compared to active pulmonary tuberculosis they run about 3 to 1. Most of the gassed cases that I see here are in these two groups.

I have dealt with gassed patients about three years. Was consultant in chest diseases, and by accident, Gas Officer to the 7th Division when the Division was gassed. After returning to America was sent to the Demobilization Board and Letterman General Hospital, later for a short time to Fort Bayard. I am consultant here, with patients from a large area, for U.S. P. H. S., B. W. R. L., F. B. V. E., etc.

I believe that the gas evil is greatly overestimated by the lay public and by doctors who are not chest diagnosticians. I think, too, the men having the Asthma-Emphysema syndrome are the most unjustly treated, - this because of the ignorance of the doctors examining them.

J. P., Fort Worth, Texas.

No. 62. October 13, 1921.

Replying to your inquiry as to the after effects of gas inhalation:

May I state that as consultant in cardiovascular and Pulmonary Diseases at the U.S.P.H.H 37 during the last two years, it has been my privilege to examine approximately one thousand cases, a vast majority of which claimed to have been gassed. The gases encountered were mainly phosgene and chlorine. Rigid physical; X-Ray, fluoroscopic and electrocardio graphic examinations with control of temperature records convince me-

(1) That the larger and smaller bronchi are most frequently involved, and that a chronic capillary bronchiits is common;
(2) That bronchiectasis is not an infrequent concomittant and is generally diffuse;
(3) That there is rarely any asthma present, but that in approximately 1-2 per cent of these cases a definite pulmonary tuberculosis has developed;
(4) That involvement of the lung tissue itself is indeed seldom encountered;
(5) Effort syndrome (N.C.A.) is extremely common, but in each case may be directly attributed to nerve shock, influenza or other infection, rather than to the effects of gassing;
(6) I do not believe the heart or blood vessels are ever involved organically.

W. F. R., Milwaukee.

No. 63. October 2, 1921.

Since May, 1920, I have seen as attending Specialist in Internal Medicine, U.S.P.H. Service, In R--263 ex-service men. Of these 63 gave a history of gassing (23.95%). The symptoms immediately following exposure to gas were of the:

Respiratory type	19
Abdominal type	16
Surface type	2
Respiratory & surface types	3
Respiratory & abdominal types	15
Abdominal & surface types	2
Respiratory, abdominal & surface types	4
Undetermined	2

(patients statements)

I believe that symptoms presented by the men who have been gassed, one year or more after the exposure to the gas on the battlefield, are due to neurosis, which should be treated as other neurosis are treated.

"The cough which persists in these patients is usually, in my opinion, associated with congestion with the larynx; most often in the ventricle, which I consider curable by suitable local applications. As a rule there are none of the physical signs of a bronchitis in these men. In one or two cases there have been signs of bronchitis and X-Ray examination has shown some bronchial relation between these findings and the exposure to gas. It seems to me as reasonable to consider gas a cause of syphilis because a man who has been gassed is found to have a 4 plus Wassermann and denies a local sore. If gas was a cause of chronic bronchitis and bronchiectasis more than one or two cases out of 63 would show the conditions.

"I have had no deaths in men who were gassed. I believe the majority of the cases are curable eventually; if they are not coddled."

"J. M. S." Rochester, N. Y.

No. 64. October 18, 1921.

"As the cases which came under my surveillance, I saw but a few hours and very early, the questionnaire published in the Journal of the A. M. A. , August 6, 1921, does not seem to apply.

"The 167 Field Hospital, 42nd Division, handled all the gas casualties in our section of the drive late in July 1918, in the Chateau Thierry salient. In five days time I handled personally 1100 alleged gas casualties. The method in vogue at that time was the salvaging of all the patients' clothing and evacuating them in pajamas, etc.

"The following are my deductions from this experience: -
1. To be conservative, but one-fourth of this number were true warfare gases.
2. Three-fourths were cases of pure exhaustion which, after several good feeds and rest, should have been returned to duty.
3. These cases came from battalion dressing stations, diagnosed "gassed".
4. Under the exigencies and stress of shell fire, but three diagnoses were made in battalion dressing stations, namely seriously wounded, slightly wounded and gassed.
5. When the exhausted man gets a whiff of gas from high explosives, or even small arm fire, he is "gassed" as far as being an effectual is concerned.
6. Excepting a few cases of burns by mustard gas, outside the symptoms of bronchial irritation of greater or lesser degree, there was no pathological changes evident at this stage.
7. A large percentage of these cases were produced by sleeping

in shell holes in a terrain which had been swept by gas previous, awaking with vertigo, nausea and headache.

"In conclusion, it is my belief from my limited experience in examining ex-service men claiming disability resulting from warfare gas:-

1. The suggestion of "gassed" was made. He was evacuated as a gas casualty. The suggestion has stuck.

2. The suggestion produces the pulmonary symptoms in the mind.

3. It is my opinion that "gassed" in many instances, enters the same category as the involuntary action of self-defense called shell shock.

4. The same physical symptoms of peri-bronchial infiltration is evident in cases never having the distinction of wearing a diagnosis tag marked "gassed".

5. I believe resolution is complete from the irritation produced in these slightly gassed cases.

6. Economic conditions are no doubt responsible for a large number of claims and obscure and slight pulmonary symptoms."

"E. F. S." Indianapolis, Ind.

No. 65. January 4, 1922.

"With particular gassing and neurosis, it is my opinion that gassing is a convenient peg on which the neurotic individuals are prone to hang all manner of symptoms. In most instances the gassing probably causes no anatomical change, but the neurotic individual is firmly convinced that gassing has caused his trouble which from a clinical standpoint is as important as if the gassing had really caused definite changes.

"A considerable number of asthmatics fairly definitely trace the beginning of their trouble to gas. Again, the gas may not be the sole cause. The individual may have been predisposed to asthma, and gas plus the excitement of war strain was sufficient to throw the body economy out of gear and produce asthma.

"With regard to blood vascular system and nephritis, it is my opinion that in some instances during the acute effects of gassing and individual may develop an anatomical heart lesion and when the acute effects of the gas have worn off

such an anatomical heart lesion may partially remain and thus contribute to the disordered and consequent post nephritis.

"With regard to chronic bronchitis, I believe that a chronic bronchitis (probably bacterial) may be superimposed upon an acute anatomical condition produced by gas and remain as a low grade chronic bronchitis.

"Gassing may also have some relaion to gastritis. Gassing almost surely has direct connection with effort syndrome, but effort syndromesis such a complex group of symptoms that no one of which may be directly charged to gassing or anything else."

"S. L. C." Washington, D. C.

No. 66. January 5, 1922.

"Personal examination of approximately 1000 War Risk Cases has furnished me no evidence that gassing produced any permanent effects in those who survive.

"Those having no other causes for their disability claim either shell shock or gas. Those cases should be classed as pension neuroses.

"My personal experience with SO-2 and formaldehyde gas in quarantine work has never furnished a case presenting any permanent effects from exposure to these gases, although I have seen a number of cases in which pain in the chest and bloody sputa persisted for several days."

"H. S. M." Massachusetts.

No. 67. January 1922.

"The statements of patients in regard to gassing are inaccurate and unreliable and the histories for this reason are not dependable. The symptoms which they claim to be due to gassing may not be due to gassing at all. So far as I am able to observe, after taking into account the conditions stated above, I am of the opinion that gassing has had but little to do with the condition of the patients I have treated in the neuro-psychiatric section of this hospital. (Government Hospital where ex-soldiers are being treated).

"P. E. B."

No. 68, January, 1922,

My experience is limited in diseases other than pulmonary diseases, and therefore I have not any opinion to express as to them. In regard to the above named diseases: There are so many men afflicted with Pulmonary Tuberculosis, Chronic bronchitis and asthma who claim gassing as the cause of their trouble and yet where it is difficult to establish the gassing as the origin or provocative agent, that I am of the opinion that gassing had little to do with the causing of their complaint.

C.E.S.

No. 69, January 14, 1922.

It will be noted that in 18 months experience with cases of the U.S. Veterans Bureau who state that they have been gassed and attribute every possible real or imagined pathological condition to the same, cases number approximately 250, that only two classes of cases have been observed in which it is believed that gas played any part whatsoever.

The first of these are a few cases of chronic bronchitis, who date the onset of their troubles to an attack of gas. The weight of evidence in these cases seems to prove that their statements are correct. However, it is to be noted that for every definite case of chronic bronchitis seen who gives a history of being gassed, there are ten patients complaining of chest trouble, also acribed to gas, in whose chests no actual pathology can be found.

In the second class are those included under diagnosis of psycho-neurosis. The great majority of these individuals were sub-standards in the beginning, and would quite probably have broken down under any stress or strain. In some of them the statement that this is due to gas is doubtless true. In this class of patients, however, the possibility of financial reward for real or fancied ills probably plays a considerable part.

W.Y.H. New Orleans, La.

No. 70, January 13, 1922.

I had under my care in France while ophthalmologist for Base Hospital 28 probably 3 or 400 cases of gassed eyes from about July 15, 1918 on to April 1919. As attending specialist in opthalmology at this station I have examined probably 200 that gave a history of eyes gassed moderately to severely.

I have not included those whose histories showed only mild gassing with symptoms practically gone in 3 or 4 days probably 95% were from mustard gas. In all the cases seen there was corneal involvement in but 5 or 6 cases (about 1%) these ranging from two or three cases with faint corneal opacities to the one case of permanent loss of vision in both eyes from dense corneal leucoma. In all the other cases there was found only a mild chronic conjunctivitis(mostly Morax-Axenfeld) in about 20% of cases. In practically all this was quite mild and did not interfere with usual vocation. In many there was probably no connection with gassing. Have seen no persistent photophobia of importance.

J.W.K., Kansas City, Mo.

No. 71, January 26, 1922.

I have the honor to submit the following comments in regard to the questionnaire pertaining to the after effects of warfare gases:

In the Government Hospitals we do not have access to the Service records of our patients, and have nothing but their statements to us as to whether they have been gassed.

My experience has taught me that there are so many of these men claiming to have been gassed who were never gassed, that any estimates made upon our clinical records would be so defective no information as to the real effect of war gas can possibly be submitted.

There are too many men claiming to have been gassed who were never possibly exposed to it. And there are too many men who were overseas who give such ridiculous statements as to how they were effected by gas, that no doubt can remain that their story is not correct.

It is my impression, however, that even if all were gassed who claim to have been gassed there has been no real cause to believe it has been a contributing cause to the development of the latent tuberculosis. If this were not true, I firmly believe we would find far more cases of tuberculosis than we are finding.

J.R.W., Palo Alto,Calif.

No. 72, January 11,1922.

Referring to the enclosed questionnaire pertaining to the after effects of warfare gases, I have the honor to report that about 20 per cent of the cases that I have examined including tuberculosis, chronic pulmonary, and other respiratory diseases, attributed their disability to war gases.

In my opinion, cases accredited to gases are due to other causes in practically every instance.

J. A. W., Evansville,Ind.

No. 73. January 14, 1922.

"I have been placed in a peculiar position in handling these men, who conscientiously attributed all their present ailments to gassing. These men have been at the front and have had some encouragement, psychic or otherwise, concerning the serious effects of some slight gas which may or may not have occurred. Since the time of this first encouragement, they have had their feelings further developed and finally established into a conscientious belief. Those of us who have attempted to re-establish these men in the face of their present established belief that gassing is the cause of all evil, dare not bluntly state that gassing is not the cause of their present condition. Such a stand by a Government Representative would further establish in the minds of the claimant the already too prevalent belief that the Governments purpose is to deprive, rather than aid the men to get their just compensation for injury incurred in the service.

"Were we to consider the Government alone, our efforts might be less aggressive, but when one considers the resulting community hazard of unemployment for those physically fit and then most of all, the certain corroboration for the individual when non-disabling physical conditions are coddled through ignorance and romance of the unknown, into a psychic disability. We are stimulated to ask for the cooperation of the family physician.in our effort to re-establish and reassure these men.

"Without their cooperation and finally that of the public at large, we cannot hope for that degree of re-habilitation which is possible for those so disabled. Our duty to a man coming to our office with a self-diagnosed report of Typhoid Fever, in which we find no positive Weidal, no rose spots, no fever with slow pulse, or other signs of typhoid, is plainly to disuade the man he has Typhoid. In this condition, our ignoranee concerning gassing permits us to take into consideration the patients convictions and we almost accept their fictitious story and even encourage further belief on the part of the claimant that his disability is due to gassing.

"Tuberculosis has not been increased by this war, as is indicated by the following figures and statements which have been collected by Dr. James A. Miller and reported in the American Review of Tuberculosis, Volume 3, page 351. There seems clear evidence that tuberculosis has not been increased by the influence of this war upon armies in the field and if anything it diminishes the hazard from pulmonary tuberculosis.

[illegible]

"Here we to consider [illegible] the claim, our efforts might be less expensive. But [illegible] we considers the resulting community based on [illegible] that [illegible] invariably fit and then most of all, the [illegible] compensation for the individual when non-disabling physical conditions are modified through ignorance and fear of the unknown, into a psychic disability. [illegible] to the cooperation of the family physician in [illegible] establishing and preserve these men.

"Without their cooperation and [illegible] family [illegible] the public is large, we cannot hope for much [illegible] rehabilitation which is possible for those in disability. [illegible] duty to a man coming to our office with a self-diagnosis [illegible] of typhoid fever, in which we find no positive [illegible], a rose spots, no fever with slow pulse, or other signs of typhoid, is plainly a disaude the man be has typhoid. In this condition, our [illegible] concerning passing permits us to [illegible] the [illegible] tion the patients convalescence [illegible] the [illegible] fictitious story and even encourage further [illegible] part of the claimant that his disability [illegible] massive.

"Tuberculosis has not been increased by this war, as is indicated by the following figures and statements which have been collected by Dr. [illegible] Miller and reported in the American Review of Tuberculosis, Volume 3, page 381. [illegible] seems clear evidence that tuberculosis has not been increased by the influx of this war even [illegible] in the field and if anything it [illegible] the hazard from pulmonary tuberculosis.

Tuberculosis in Armies.

France	Early months of the war	1.75
	Last two years of War	.63
Great Britain	Before War, entire army.....	1.1
	First 17 months of war	1.1
	Hospital cases to 4/30/18.....	.92
Belgium	Before War, entire army	.35
	During the war, entire army	.26
United States	Regular Army-1917-1918	.75
	Officers' Training Camps.....	.27
	17 Div. National Guard	1.09
	National Army.....	.67
	Entire Army 1,406,498 men.....	.78

"One case of clear gassing disability is now under care. It is a case of bronchiectasis, without the history of influenza, pneumonia, or abscess, and with clear history of having had no disability prior to gassing. The young man handles six languages well and five others, fairly well, is a typist and was in charge of the Medical Records at Fort Bayard for six months. He now realizes his condition and that he is a social outcast.

"In the prone Trendellenburg's position three times a day, he drained from 5 to 12 ounces of pus. Analysis shows this pus to contain no tubercle bacilli. This is the only clear case of serious sequelae in the lungs, following gassing, that has come to my attention after a study of some 15,000 case records.

"We again plead for the cooperation of the Medical Profession in the re-habilitation of these disabled men and trust that the profession will make practical use of the knowledge obtained."

"W. H. W." Chicago, Ill.

No. 74. January 16, 1922.

"It has been my lot to have examined hundreds of World War Veterans suffering from tuberculosis. It is my impression that very few of these cases are the result of gassing. My belief is that gas can be rated as a contributory cause along with camp life, exposure, military stress, and other known factors causing a lowering of vitality. I am inclined to relegate gassing to a rather minor role in the causation of tuberculosis among army men. It is evident that the incidence

of tuberculosis in service men is as large or nearly so among men of the Navy and those who never went overseas and were not exposed to gas, as those exposed. The histories in regard to gassing by those men are often very vague and we have not considered a man truely gassed unless he required hospitalization for it. There is no doubt that gassing has caused other respiratory troubles as chronic bronchitis and bronchial fibrosis. Many of these cases have been erroneously diagnosed and hospitalized for tuberculosis, and created much confusion and distress of mind to both patient and physician."

"E. P. P."

No. 75. January 16, 1922.

"Briefly stated, the definite knowledge possessed by me relative to the effect of gassing upon patients treated at this hospital is negative. This does not mean there is any definite evidence to show that gassing has not left after effects, but that we lack definite evidence to show that it has. Definite changes in the lungs traceable to gassing we have not been able to demonstrate. Symptoms traceable in part, either directly or indirectly to war experiences have frequently appeared, but it has been difficult to say how much these are due to gassing, how much to other war experiences, and how much to underlying constitutional defects existing prior to the war and aggravated by it. It is believed that most of the symptoms now present in any patient are not due to structural changes in the lungs. Cases of tuberculosis have not been demonstrated to have developed as a result of gassing.

"Organic lesions of the cardio-vascular and other symptoms in patients here have not been demonstrated to have resulted from gassing. I have no definite autopsy experience bearing on the subject.

"C. M. M." North Carolina.

No. 76. January 16, 1922.

"Relative to the part played by gas as an etiological factor inorganic and functional disturbances of the nervous system, my experience has forced me to the following conclusions.

1. Warfare gases do not permanently effect the brain and central nervous system.

2. The role played by gassing in the functional nervous disorders (neurosis) is in my opinion purely psycological. The gas per se is not an etiological factor, but the incident with its associations with shell fire, stress and strain of warfare, etc., may act as an exciting cause in a predisposed individual resulting in a neurosis. It must be borne in mind that the neurosis are largely defence reactions on the part of the individual and that many men attribute their nervous condition to gassing who in reality have never come in actual contact with it."

"E. P. B." North Carolina.

No. 77, January 18, 1922.

I would say from my personal experience from an examination of several thousand ex-service men that gas is not a primary cause of tuberculosis. By that, I mean that gassing does not cause a primary tuberculosis infection, although it may be an important factor in causing an old quiescent tuberculosis to again become active.

I do believe, however, that it plays a very important part in the cause of chronic bronchitis and asthma, as the gas in these cases would cause more or less thickening in the bronchi.

It has also been my experience, that in the cases of tuberculosis, which we find in the ex-soldier, that as great a number of cases are found in men who were never gassed or over in France as in those who were over and give a history of being gassed.

Then, also, there is the authenticity of the gassing to be considered, as very few give a history of being confined to a hospital for any length of time for gas.

L. H. F.

No. 78, January 19, 1922.

My experience is based upon seven months duty at Camp Hancock, Augusta, Georgia, during part of which time we treated approximately 135 invalid soldiers sent back because of gas. Secondly, approximately two years' service at General Hospital No. 19 and one year and a quarter service in the U.S.P.H. Hospital No. 60. In these various stations numerous cases have presented themselves, giving the history of inhalation of poisonous gas, but without adequate history of immediate treatment for these conditions and in practically all cases of this sort, aside from possibly a few cases of chronic bronchitis that were believed, though we were unable to prove, were caused by gas, and an excess of the nervous element, such as cardio vascular, esthenia, shell shock, etc., we have been unable to show any close relationship between tuberculosis or other pulmonary diseases and inhalation of poisonous gas.

The marked cases of inhalation of poison gas with distinct histories of immediate treatment have shown in certain cases signs of fibrosis (pleuro-pulmonary), evidently greater than what the history of the tubercular infection would indicate. However, it is perfectly possible that a small gas

infection was super-imposed on a pre-existing tuberculosis and owing to the stress and strain of front line work had not been differentiated.

In recapitulation, at the present time there is no especial connection between inhalation of poison gas and tuberculosis, and I believe that in the severe cases of gas poisoning pulmonary fibrosis may take place as well as a chronic bronchitis result. My experience in cardio-vascular examination of approximately 5000 service and ex-service men for the last three and one half years makes me very much doubt if in the ordinary cases there is a connection between either organic or functional cardiac diseases and gas poisoning. I do find, however, that there seems to be an increase in the nervous disorders in many cases shown by the so-called "Disordered Hearts" of some soldiers.

C.O.P.

No. 79, January 20, 1922.

My impressions result from X-ray examinations and clinical conferences on many "gas cases" at Mesves Hospital center, A.E.F.,where I was consultant in X-rays and Roentgenologist in Base Hospital No.-- for seven or eight months, in 1918 and 1919. Then at U.S.A. General Hospital No.--- where I examined between 8000 and 9000 chests of tuberculous soldiers and suspects during fifteen months and later in U.S.P.H.S. Hospital No. -- and No.-- at which places I am X-ray Consultant. In all approximately 10-000 cases.

Pardon the lengthy reference; I wish to indicate that my impressions are based on considerable experience.

IMPRESSIONS.

1. So many men state that they have been gassed who show no physical evidence to sustain their statements that it is almost impossible to collect reliable statistics.

Some men willfully say they have been gassed when they have not. Some men smelled warfare gases and have imagined themselves to have been gassed when they should not be considered as gas cases, for they inhaled too little gas to produce pathological changes. A third and this is probably the smallest group have been gassed and show the changes which are to be expected. I only mentioned the

first group because I believe there are some such men. The second group is probably the largest. These men because they have been pitied and sympathized with inordinately and because their imaginations are vivid, attribute all their ailments to gas inhalations and have been so treated in hospitals to their detriment. The third group is made up of those who actually show pathological changes which can be demonstrated in carefully made X-Ray stereoscopic chest plates.

2. Such plates show no changes which might not result in subjects who had never inhaled warfare gases. They occur as indicated below.

a. The larger bronchi are abnormally thick and prominent and their branches also. These changes are noted in all the bronchi as they radiate from the hili. Also the hilum shadows are dense and larger than normal. These are the characteristic changes to be demonstrated in chronic bronchitis from any cause.

b. Emphysema, bronchiectasis and pulmonary abscess may develop as secondary result of chronic bronchitis from any cause if it is severe.

c. Gassing has made men more susceptible to pulmonary tuberculosis and has reactivated quiescent foci of infection but is not a common factor in developing tuberculosis in soldiers.

d. Comparing the X-Ray plates of tuberculous subjects who have been gassed with those of men who have pulmonary tuberculosis and who have not been near warfare gases, discloses no characteristic differences.

e. The mental state produced by a desire to create interest of one sort or another and established by over estimating the after effects of gas inhalation in the treatment of such men furnishes the greatest and most difficult thing to be dealt with in gas cases."

"J. C. McR." Asheville, N. C.

No. 80. January 20, 1922.

"In reply to U. S. Public Health Service Bureau letter dated December 30, 1921, regarding the after effects of warfare gases, I desire to submit this paper:

"1. From my observation in the treatment of ex-service men in Government Hospitals since November 1918, it is my opinion that bona fide cases of severe gas inhalation may result as follows:

Respiratory tract; chronic bronchial and fibrotic lung changes.

"A contributory factor in production of ductless gland and sympathetic nervous system disfunction, with resulting tachycardia, hyperhydrosis, tremors, vasometer changes, dyspnea, emotional instability, etc., and with subsequent development of a neurosis in many instances.

"N. W. P."

OPINIONS OF OTHER MEDICAL MEN.

Realizing there were many Medical men scattered throughout the country who not only had extensive experiences in treating gas cases in France, but also since returning to this country, it was deemed of the greatest importance to obtain their views so they were communicated with through the different Medical Societies and the columns of the Medical Journals.

In order to have a uniformity of replies concerning the subject, questionnaires were prepared which together with mimeographed letters, as per the following, were used.

The accompanying table was prepared from replies received:

"My dear Doctor:-

The late war with the Central Powers introduced several new and important weapons, such as the submarine, air bomb, tank, flame thrower and war gas. All of these were important agents in the production of new types of traumatism, especially gas, which, viewed from the standpoint of the medical men, was the most important, and directly responsible for thousands of casualties occurring in our forces operating in France.

Due to the fact that gas was a wholly new and unknown factor, affecting principally the respiratory system, it has been difficult not only to determine the amount of damage done to the system but also to other internal organs of the body. For this reason gas is now and will unquestionably for years to come, be blamed for many ailments for which it is in no way responsible. Unfortunately, medical literature both domestic and foreign, relative to the after effects of gas on the internal organs of the body, is rather negative.

Prior to the discharge of many gassed soldiers undergoing treatment in the hospitals of this country, the reports in the Surgeon General's Office showed, that a large number of them complained of tachycardia, pain in the chest, dyspnoea, sweating and asthma. Insufficient changes in the respiratory tract were found to account for these symptoms complex, and it was the opinion of many of the medical officers who treated these cases that the symptoms were the expression of a neurosis introduced on the suggestion of gassing. It was also the opinion of these medical men that the neurosis was a

defensory reaction on the part of the individual, as the so-called shell-shock cases were in a large measure a defense action on the part of soldiers who had been subjected to high explosive missiles on the field of battle.

At Fort Grant in 1919, a Board of Medical Officers of the Army examined over 2,000 men who were gassed, and after careful individual and group examinations, reported the following definite conclusions:

(a) That gas victims, irrespective of the type of the gas and severity of attack sustained, showed no marked predisposition toward pulmonary tuberculosis or toward the re-activation of a healed or quiescent lesion.

(b) That gas victims presented little evidence of material destruction of lung tissue.

Notwithstanding the report of this Board and the opinions of others who have given the subject much study and who concurred in the findings of the Fort Grant Board, former service men are breaking down at an alarming rate from tuberculosis and lung troubles, and a large percentage of them attribute their conditions to the remote effects of war gases.

There is no doubt many ex-soldiers are suffering from the ill effects of warfare gases, but on the other hand a large number are not, and in justice to them and to the Government, it is of the greatest importance to know the exact after effects of this new war weapon.

It is believed the only logical means of obtaining this information is from medical men who have encountered cases of this character, and it is felt the best way of reaching them is through the different medical societies. To that end I am addressing this communication to you, you being the Secretary of the Medical Society in your district, and if not asking too much, I wish you would refer this matter to the members of your Society who have had experience with cases of this character. I am also enclosing a questionnaire to be used in connection with their reports.

It is intended to publish a complete summary on the results of this work mentioning the names of the societies and individuals contributing, but, if for any reason it is desired to withhold the names of contributors, the request will be so honored.

In view of the importance of this matter and its far-reaching results, it is earnestly requested the subject be given careful consideration and I assure you any information will be greatly appreciated.

Trusting to hear from some of the members of your Society, I remain"

Table No. 2 and Graphic Chart No. 6 were prepared from information obtained through this means.

OPINIONS OF COMMANDING OFFICERS IN CHARGE OF GOVERNMENT HOSPITALS.

Since the war, thousands of ex-soldiers have been undergoing treatment in numerous government hospitals for tuberculosis and other diseases which they attribute to the effects of warfare gases.

In order to obtain information concerning these cases, the Commanding Officers of the different hospitals were communicated with through the Surgeon General of the Public Health Service.

The following letter was used for this purpose:

Dec. 31, 1921.

"Medical Officer in Charge,

Sir:-

In view of the urgent necessity of obtaining reliable information concerning the subject of after effects of warfare gases and their relation to tuberculosis, and other respiratory diseases, this communication is addressed to you. This matter is of the utmost importance, especially at this time when there seems to be such a variance of opinions concerning this phase of gas warfare.

There is scarcely a functioning organ in the body whose distrubed action at some period of its existence during or subsequent to its participation in the great struggle for human liberty, either at home or abroad, but has had the blame for erratic performance laid at the door of poison gas. Other things quite as important and which might also be responsible for these after effects never being considered.

In connection with this subject, it must be realized that a large number of ex-soldiers now incapacitated for conditions attributed to gas, were subjected to other influences which might have some bearing on their conditions.

Chart No. 7 expresses graphically the after effects of warfare gases on the human organism, together with number of cases seen and percentages upon which Physicians in private practice based opinions.

WARFARE GASSES AND THEIR AFTER EFFECTS.

Summary of opinions of Seventy five Doctors throughout the United States who have treated ex-soldiers suffering from conditions attributed to the after effects of war fare gasses.

Conditions	(CASES REPORTED) NUMBER	PCT.	Pr-ct Expressed graphically
DO NOT AFFECT BRAIN-CORD.	4[illegible]5	92	
Do affect the brain-cord.	405	8	
DO NOT AFFECT THE EYES.	4[illegible]	6[illegible]	
Do affect the eyes.	8[illegible]	1[illegible]	
DO NOT AFFECT THE EARS.	4[illegible]	9[illegible]	
Do affect the ears.	515	6	
DO NOT AFFECT THE LARYNX.	2[illegible]	8[illegible]	
Do affect the larynx.	2[illegible]	2[illegible]	
DO NOT AFFECT VOCAL CORDS.	[illegible]	[illegible]	
Do affect the vocal cords.	2[illegible]	[illegible]	
DO NOT AFFECT LARGE BRONCHI.	[illegible]	6[illegible]	
Do affect the large bronchi.	1315	[illegible]	
DO NOT AFFECT SMALL BRONCHI.	3[illegible]4	74	
Do affect the small bronchi.	1[illegible]	2[illegible]	
DO NOT PRODUCE BRONCH'TSIS.	2[illegible]7	73	
Do produce bronchiectasis.	[illegible]	27	
DO NOT PRODUCE EMPHYSEMA.	2[illegible]	[illegible]	
Do produce emphysema.	1[illegible]	31	
DO NOT AFFECT LUNG TISSUE.	[illegible]	47	
Do affect lung tissue.	[illegible]	53	
DO NOT AFFECT THE HEART.	[illegible]	[illegible]	
Do affect the heart.	[illegible]	[illegible]	
DO NOT AFFECT BLOOD VESSELS	[illegible]	8[illegible]	
Do affect the blood vessels.	[illegible]	1[illegible]	
DO NOT AFFECT COMPOS'N BLOOD.	[illegible]	[illegible]	
Do affect composition blood.	[illegible]	[illegible]	
DO NOT AFFECT THE KIDNEYS.	[illegible]	9[illegible]	
Do affect the kidneys.	[illegible]	1[illegible]	
DO NOT AFFECT ORGNS. DIGESTION	[illegible]	9[illegible]	
Do affect orgns of digestion.	[illegible]	1[illegible]	
DO NOT CAUSE TUBERCULOSIS.	[illegible]	9[illegible]	
Do cause tuberculosis.	[illegible]	1[illegible]	
DO NOT CAUSE ASTHMA.	2489	70	
Do cause asthma.	1004	30	
DO NOT CAUSE BRONCHITIS.	2[illegible]3	71	
Do cause bronchitis.	1[illegible]	29	
DO NOT CAUSE NEPHRITIS.	4[illegible]	9[illegible]	
Do cause nephritis.	3[illegible]	8	
DO NOT CAUSE NEUROSIS.	5[illegible]	12	
Do cause neurosis	3[illegible]6	[illegible]	
DO NOT PRODUCE PSYCHONEUROSIS	3[illegible]6	11	
Do produce a psychoneurosis.	3[illegible]4	[illegible]	
DO NOT PRODUCE EFFORT SYNDROME	1[illegible]	[illegible]	
Do produce an effort syndrome.	2644	6[illegible]	
DO NOT PRODUCE GASTRITIS.	3[illegible]2	73	
Do produce gastritis.	1[illegible]5	27	

Chart No. 8 expresses graphically the after effects of warfare gases on the human organism, together with number of cases seen, and percentages upon which Government Hospital Medical officers based opinions.

WARFARE GASSES AND THEIR AFTER EFFECTS.

A summary of opinions of thirty three doctors associated with Government Hospitals where ex-soldiers are receiving treatment.

Condition	CASES REPORTED NUMBER	Perct.	Pr-ct expressed Graphically. 10 20 30 40 50 60 70 80 90 10
DO NOT AFFECT BRAIN-CORD.	14[illegible]	[illegible]	
Do effect brain-cord	750	[illegible]	
DO NOT AFFECT THE EYES.	12375	84	
Do affect the eyes.	2300	16	
DO NOT AFFECT THE EARS.	14175	96	
Do effect the ears.	500	4	
DO NOT AFFECT THE LARYNX.	14675	74	
Do effect the larynx.	4000	26	
DO NOT AFFECT THE VOCAL CORD	12375	86	
Do affect the vocal cords.	2500	14	
DO NOT AFFECT LARGE BRONCHI.	10825	59	
Do affect the large bronchi.	6050	41	
DO NOT AFFECT SMALL BRONCHI.	10825	58	
Do affect the small bronchi.	7850	42	
DO NOT PRODUCE BRONCHIECTASIS.	13675	91	
Do produce bronchiectasis.	1300	9	
DO NOT PRODUCE EMPHYSEMA.	13175	93	
Do produce emphysema	1250	7	
DO NOT AFFECT LUNG TISSUE.	12375	83	
Do affect the lung tissue	2500	17	
DO NOT AFFECT HEART.	14175	89	
Do affect the heart.	1800	11	
DO NOT AFFECT BLOOD VESSELS.	14375	99	
Do affect the blood vessels.	300	1	
DO NOT AFFECT COMPOS. BLOOD.	14675	100	
Do affect composition blood	0	0	
DO NOT AFFECT THE KIDNEYS.	14675	100	
Do affect the kidneys	0	0	
DO NOT AFFECT ORGS. DIGESTION	14675	100	
Do affect organs digestion.	0	0	
DO NOT CAUSE TUBERCULOSIS.	13075	89	
Do cause tuberculosis.	1600	11	
DO NOT CAUSE ASTHMA.	13325	77	
Do cause asthma.	4130	23	
DO NOT CAUSE BRONCHITIS.	12425	80	
Do cause bronchitis.	3250	20	
DO NOT CAUSE NEPHRITIS.	17875	100	
Do cause nephritis.	0	0	
DO NOT PRODUCE NEUROSIS.	10125	70	
Do cause a neurosis.	4050	30	
DO NOT PRODUCE PSYCHONEUROS.	9775	59	
Do produce a psychoneurosis	4000	31	
DO NOT PRODUCE EFFORT SYNDRM.	9225	71	
Do produce an effort syndrome	3800	29	
DO NOT PRODUCE GASTRITIS.	18675	100	
Do produce a gastritis.	0	0	

Twenty three of the above doctors claim there are no serious after effects following gassing, ten claiming there are. All basing their opinions on the number of cases expressed in the columns on chart.

The majority of them, as a rule, left good homes in which all the comforts therein existed, and in joining the Army, adopted new modes of living, - some good, others bad, as a result of which, they were subjected to various exposures.

Tuberculosis was also very prevalent throughout France during the war, and many soldiers were billetted in homes recently vacated by old tubercular cases. Thus, the possibility of contracting the disease through these sources must be realized. The period of time since 1917 to the present has offered ample opportunity for the onset of diseases totally unassociated with the war or war exposure, as well as for the development of latent or chronic diseases. A terrible epidemic of respiratory diseases, especially influenza, was prevalent during the gas danger period. As a result, over 700,000 soldiers, including many who were also exposed to gas, were admitted to Army hospitals, with a death rate of over 10%, or five times greater than produced by gas. Therefore, the possibility of many cases of tuberculosis now accredited to gas, might have been due to one of these other causes.

It may be of interest to you to know that as a result of a careful check by Government officials of some 1200 applications for pension, taken at random in the U. S. Veterans' Bureau, over 31% of the disabilities were attributed to gas, and of 582 cases of tuberculosis examined, 24% claimed gas responsible for their conditions, and of 225 cases of bronchitis 71% claimed gas responsible.

The Government realized the seriousness of this matter and has been making an exhaustive study of it. During this investigation, over 3,500 letters were sent to physicians of this country and Europe, with a view to obtaining their views concerning this subject. Gas manufacturers and others were also communicated with for the same purpose. While much valuable information has been obtained through these sources, there still remains an element of doubt concerning the relation of after effects of gas to tuberculosis, and in order to secure additional information along these lines, it has been decided to communicate direct with the different tuberculosis hospitals throughout the country. This communication is sent to you for the purpose of obtaining your views on this subject, as well as those of the members of your staff.

For your information as to what has already been done along these lines, there is enclosed herewith copy of letter and questionnaires that have been used exten-

sively. If the latter can be of any use to you in filing your replies, you are requested to use the same. Special information is desired pertaining to clinical and post mortem findings. What is wanted at this time is reliable information of any kind which will throw some light on this particular phase of this important subject. The time has arrived when the Government must know whether gas is or is not responsible for the large number of tuberculosis patients credited to it.

Upon completion of the enclosed form, mail it direct to Lieut. Colonel H. L. Gilchrist, Medical Corps, U.S.A., Chief, Medical Division, Chemical Warfare Service, Munitions Bldg., Washington, D.C.

By direction of the Surgeon General:

Respectfully, "

The information obtained through this means is expressed by figures and graphic waves on Table 3 and Chart No. 7.

In all cases, the opinions of the Medical Officers commanding these hospitals were based on the number of cases seen and expressed in the various columns of the charts or tables.

(Table 3 and Chart 7 enclosed.

The following letter with tabulations has been received from the Commanding Officer of Veterans' Bureau Hospital No. 67, Kansas City, Mo., but too late to have been included in Table 2 and Chart No. 6. This information, however, is of such importance that it is being published separately. It not only expresses in figures actual number of cases treated at this large hospital but gives the percentages of the cases resulting from different causes.

It also serves the purpose of emphasizing the point of similarity between conditions resulting from the effects of Influenza and warfare gases, which has been mentioned elsewhere in this report.

Letter and tabulations follow:

" With further reference to your request for information as data became available relative to patients coming under observation with a history of GAS there is enclosed herewith a statement transmitted on March 16, 1922, from the Medical Officer in Charge, U.S.V. Hospital #67, Kansas City, Mo., which may be of casual interest.

By direction of the Surgeon General,
U.S.P.H.S. "

"U.S. Veterans' Hospital #67, Kansas City, Mo.

During the year from March 1, 1921, to February 28, 1922, a total of 1654 patients were examined in this hospital.

Of these -

284 cases showed positive diagnosis of pulmonary tuberculosis.
145 cases gave a previous history of having been gassed.
82 " " " " " " had Influenza.
8 " " " " " " " " and gas.
149 cases did not give a history of either Influenza or of having been gassed, their disease having developed from other causes.

Of the -

145 cases giving a history of having been gassed-
45 have developed pulmonary tuberculosis.
56 have developed bronchitis or other chest conditions not tuberculosis.
44 have apparently suffered no after effects, insofar as diseases of the chest are concerned.

Of the -

357 cases which gave a history of having had Influenza
82 have developed pulmonary tuberculosis.
92 have developed bronchitis or other chest conditions not tuberculosis.
183 have apparently suffered no after effects, insofar as diseases of the chest are concerned.

Of the -

21 cases which gave a previous history of having had Influenza and also gassed -
8 have developed pulmonary tuberculosis.
10 have developed bronchitis or other chest conditions not tuberculosis.
3 have apparently suffered no after effects, insofar as diseases of the chest are concerned.

OPINIONS OF CHEMICAL MANUFACTURERS.

In conducting this investigation, it was believed important to obtain the views of the different chemical manufacturers throughout the United States concerning the effects of gas on their employees whom in many cases had been affiliated with their establishment for many years and who, undoubtedly, on many occasions hadbeen exposed to the direct effects of gases, which, in many respects were identical with those used in the war. To that end, the following letter was addressed to these chemical manufacturers.

"Gentlemen:-

I am taking the liberty of writing you concerning a subject which at this time is of the greatest importance. As you probably know, the use of chemical gases was employed extensively by all the countries participating in the recent war. As a result, hundreds of thousands of casualties occurred. In our own army alone, over 72,000 men were taken from the front lines as a result of being gassed.

Due to the fact that gas was a wholly new and unknown factor in the war, and also, to the fact that gas affected the internal organs principally, it has been difficult to determine the actual amount of damage done to the respiratory and other internal organs of the body. For this reason, gas is new and will unquestionably for years to come, be blamed for many ailments unless something definite is proven concerning its after-effects. Unfortunately, medical literature both domestic and foreign relative to the latent effects of gas on the internal organs are rather negative.

It seems to be the consensus of opinion of those who have given the subject the closest study, that there is no apparent reason why those subjected to gas should suffer any permanent effects. Notwithstanding these opinions, however, thousands and thousands of ex-soldiers are now making applications for disability pensions for ailments due to conditions of the internal organs, which they claim are from the effects of warfare gases. As a result, you can readily see the necessity for reliable information concerning this important subject, especially in view of the fact that the use of chemical gases have been decided upon as one of our future war weapons.

There is no doubt some of these men are suffering ill effects from warfare gases, but on the other hand large numbers are not, and in justice to those and the United States Government, definite information relative to the exact after-effects of these gases should be known.

The only logical means of obtaining this is from the manufacturers throughout the country who have had experience in this subject; or from medical men who have been called upon to treat men suffering from conditions claimed to be due from gas. If it is not asking too much, I wish you would give me your personal views on the matter, especially relative to any permanent disabilities from gas in old employees who have been in your establishment. Any other information that you can give which will assist us on this important subject will be gratefully received.

Very truly yours, "

In reply to these letters, the following answers have been received:-

- - - - - - - - - - - - - -

OLDSBURY ELECTRO-CHEMICAL COMPANY

WORKS

Niagara Falls, New York.

February 22, 1921.

Chief of the Medical Division,
Chemical Warfare Service.,U.S.A.,
1800 Virginia Ave.,
Washington,D.C.

Dear Sir:-

Yours of the 16th inst. at hand.

I am afraid that we have absolutely no information to give you on this subject of the after effects of gassing.

During the whole of our operations here we were so fortunate as not to have, either among our own employees or among the C.W.S. men stationed here, a single serious case of phosgene poisoning; by a serious case I mean one involving serious secondary symptoms. Of course, we had a number of exposures resulting in high pulse, sometimes vomiting, and some bronchial disturbance; but all these cases showed rapid and apparently complete recovery within a few days.

I have just been discussing your letter with one of my assistants, Mr. F. A. Stamps, who was the subject of about as serious a case of gassing as we had, and he tells me that, though he no longer feels any ill effects, he was subject for a long time afterwards to very shaky nerves, - couldn't hold a pen steadily and that kind of thing. This reminds me that we seem to observe a tendency to nervous

disturbance in some of the men engaged in operating the phosgene plant. This might be due either to the specific effect of phosgene(even in smaller quantities than necessary to give any other symptom) or to the psychological effect of continual work under apparently constantly dangerous conditions. However, we have no reason to suppose that such nervous disturbances are anything but transitory.

All we can say, therefore, is that though no case of permanent disarrangement through phosgene poisoning has come to our notice, we did not have a single case of such severity that permanent effects could be expected.

Yours very truly,

(Signed) F. A. LIDBURY,

THE OLDSBURY ELECTRO CHEMICAL CO."

- - - - - - - - - - - - - -

ZINSSER & CO.
Manufacturing Chemists,
Hastings-on-the-Hudson, N.Y.

February eighteenth,
1921.

The Chief of the Medical Division,
Chemical Warfare Service, U.S.A.,
18th St. & Virginia Avenue,
Washington,D.C.

Dear Sir:-

This is in reply to your letter of February sixteenth, contents of which we have carefully perused.

Unfortunately, we cannot give you any very definite data on gas injuries, because we have only very few processes in our particular line that require the use of toxic gases. We have had occasions of Chlorine poisoning but with the proper care, no ill effects have been observed. We have among our employees, men who have worked with bleaching powder and chemicals in general for the last twenty-five years in our own establishment, and none of them are suffering from any industrial illnesses. Whether the conclusions that we arrive at can be properly applied in the case of soldiers who

were gassed and did not receive the prompt relief that we are able to give them in a peace-time establishment, is naturally a question, but it is our own opinion and experience that if, in the case of ordinary gas poisoning, prompt relief is given, that there should be no permanent future effects.

We regret that we cannot give you more valuable data.

Sincerely yours,

Zinsser & Co.
(Signed) F. Zinsser.

- -

THE DOW CHEMICAL COMPANY

Midland, Michigan.

March 23, 1921 C.E.Rice.

War Department,
Chemical Warfare Service,U.S.A.,
1800 Virginia Ave.,
Washington,D.C.

Gentlemen:-

In regard to permanent disability from effect of war gases in our Midland Plant, we would state that we had two classes of labor onnthis work during the summer of 1918 which were engaged in the manufacture of dichlorethysulphide.

One was a section of Chemical Warfare Service which consisted of about thirty men, all of which received treatment in the dispensary for burns of major and minor degree. These we have been unable to keep in touch with since they left the city. (It would be of interest to have someone visit each one of these men at a period of time to ascertain their condition which might be due to their service on the project. We have had approximately one hundred of our own employees (civilians) engaged on this work, seventy-nine of whom reported at the dispensary for treatment. We have tried to keep in touch with each man since the summer of 1918 in order that we may know his physical condition, particularly in regard to any possible after effects which might be traced directly to contact with mustard gas.

We are enclosing memorandum covering seventy-nine cases which shows that part of body eposed, degree of severity, and the results of the follow-up system, and covers the years 1919, 1920 and 1921 to date. In this memorandum an "O.K." indicates that the man has been seen and apparently is suffering no after effects. A dash indicates that it has been impossible to locate the man.

In interviewing men it has been noticed that the tendency on the part of a considerable number has been a feeling that they should receive some special or extra remuneration on account of the exposure incident to their occupation. We have also had some slight experience with the type that makes the most of an opportunity to malinger.

We would be pleased to furnish you with any additional information that you may seek from our experience in this work. We would also be very glad to know the results of your investigation of the work along these lines.

Yours very truly,

THE DOW CHEMICAL COMPANY

By Director of Health.

- -

MEMORANDUM

DICHLORETHYLSULPHIDE.

Number	Injury	1918 Degree	1919	1920	1921-1922
1	Throat, eyes, hands	Slight	OK	---	---
2	Eyes	Severe	OK	OK	---
3	Hands	Slight	OK	OK	OK
4	Feet	Severe		OK	---
5	Feet	Severe	OK	OK	---
6	Hands	Severe	OK	OK	OK
7	Leg	Severe	OK	OK	---
8	Eyes and hand	Slight	OK	OK	---
9	Hands, eyes	Malingerer		OK	OK
10	Fingers, legs	Slight	OK	OK	---
11	Hands, eyes	Slight	---	---	---
12	Arms	Slight	OK	OK	OK
13	Arms	Slight	---	---	---
14	Finger	Slight	OK	OK	OK
15	Chest, hands, foot	Foot-severe	OK	OK	---

DICHLORETHYLSULPHIDE (Continued)

Number	Injury	1918 Degree	1919	1920	1921-1922
16	Arm	Slight	---	----	---
17	Feet	Slight	OK	OK	---
18	Arm	Slight	OK	OK	---
19	Legs	Severe	OK	OK	OK
20	Eyes, face, hands	Slight	OK	OK	OK
21	Arms, eyes	Slight	OK	OK	OK
22	Arm	Slight	OK	OK	OK
23	Fingers	Slight	OK	OK	OK
24	Eyes & Respiratory)	Slight	OK	OK	OK
25	Eyes Organs)	Slight	OK	OK	---
26	Face	Severe	OK	OK	OK
27	Eyes, throat	Severe throat			
28	Eyes	Slight	OK	OK	OK
29	Eyes	Slight	OK	OK	OK
30	Arms	Slight	OK	OK	OK
31	Arms	Very slight	OK	OK	OK
32	Arm	Slight malingerer	OK	OK	OK
33	Body, foot	Slight(has hernia	OK	OK	OK
34	Finger, arm	Slight(bad	OK	OK	---
35	Eyes	Malingerer	OK	OK	OK
36	Eyes, arm	Slight	OK	OK	OK
37	Arm	Slight	OK	---	---
38	Hand	Malingerer	OK	OK	OK
39	Hand	Severe	OK	OK	OK
40	Hands	Slight	OK	OK	---
41	Arm	Slight	OK	OK	OK
42	Leg	Slight	OK	OK	---
43	Hand & Arm	Slight	OK	OK	OK
44	Chin, hand	Slight	OK	OK	---
45	Leg	Slight	OK	OK	OK
46	Hands, eyes	Slight	OK	OK	OK
47	Eye, foot, hand	Foot- severe	OK	OK	OK
48	Arm	Slight	OK	OK	---
49	Finger, hands	Slight	OK	OK	---
50	Eyes, chin, hand	Slight	OK	OK	---
51	Foot	Severe	OK	OK	OK
52	Finger	Slight	OK	---	---
53	Eyes	Slight	OK	OK	---
54	Hands, throat	Slight	OK	OK	OK
55	Hands	Slight	OK	OK	OK
56	Legs, fingers, throat	Slight	OK	OK	OK
57	Arm	Slight	OK	OK	OK
58	Hand	Slight	OK	---	---
59	Finger	Slight	OK	OK	OK
60	Arm, eye, throat	Severe	OK	OK	OK
61	Throat	Slight	OK	OK	OK
62	Leg	Slight	OK	OK	---

DICHLORETHYLSULPHIDE (Continued)

Number	Injury	1918 Degree	1919	1920	1921-1922
63	Foot	Severe	OK	OK	OK
64	Eyes, arm	Slight	OK	OK	---
65	Foot, eye	Severe	OK	OK	---
66	Hand	Slight	OK	OK	---
67	Finger	Slight	OK	OK	
68	Hand, eyes	Slight	OK	OK	OK
69	Foot	Slight	OK	OK	OK
70	Hands	Slight	OK	OK	---
71	Hand, eye, arm	Slight	OK	---	---
72	Arm	Slight	OK	---	---
73	Ankle	Slight	OK	---	---
74	Arm	Slight	OK	OK	---
75	Toe, arm	Slight	OK	---	OK
76	Eye, throat	Slight	OK	OK	
77	Chin	Slight	OK	OK	OK
78	Wrist	Slight	OK	OK	OK
79	Lower extremities	Very severe	OK		

Cleveland, Ohio.
February 21, 1921.

Medical Section,
Chemical Warfare Service, U.S.A.,
1800 Virginia Ave.,
Washington, D. C.

Dear Sir:

I duly received your valued favor of February 16th.

My plant at Bound Brook, which as you may know, was run as a branch of Edgewood Arsenal, was designed to produce five tons a day of Phosgene, and did in fact, operate at that schedule.

Prior to the Government's interest in Phosgene, I had been researching on the subject for some two years and had produced semi-commercial quantities.

During all this time there was never one serious accident.

When we started the Edgewood plant at Bound Brook, Chlorine was sent up to us in poor containers and in the first few days of the plant operation there were bad leaks of chlorine which caused considerable distress to some six or seven men who were; let us say, uncomfortable for an hour or two.

During the time that the Government plant was running at full schedule one of the men became affected and required treatment extending over two or three days. We found later that he was a very heavy drinker.

Undoubtedly if the trouble had swung over to pneumonia and the man had died, Phosgene would have been blamed.

One or two of the young chemists who went through the research and also through the later production period with me, got from time to time, little doses of gas.

Personally I had in all, three pretty heavy doses. My greatest discomfort was the tobacco reaction.

I know little or nothing of medicine; my scientific work being confined to chemistry and engineering, but I cannot, after some three or four years' work in the production and application of Phosgene, understand how it could cause permanent trouble.

There is, of course, no doubt that if a man worked year after year around apparatus producing Phosgene and breathing an atmosphere vitiated with this gas, even in a dilute form, his health might suffer.

I have seen a man fall absolutely unconscious as though he had been struck with a club upon getting one full breath of air heavily charged with carbon monoxide. He was carried to the hospital and given oxygen by the surgeon and before very long was quite all right.

In a case like this I understand the doctors watch the heart very carefully.

Phosgene does not act this way. There is a tremendous reaction in the nose and throat, coughing and choking, all of them acting as warnings; but in my own case I have found that after the local conditions have been cleared up by inhaling the chloroform and ammonia mixture and the heart was returned to normal after the carbon monoxide blood reaction has been overcome, then I am normal in every way and quite comfortable.

As a matter of possible interest to you, I may tell you something of the psychology of the situation at Bound Brook.

We simply could not hold our men and it was impossible to engage new ones. Money was not the consideration, they were just afraid.

Then it occurred to me to get out a little leaflet to be read by each man in the employ and by any new men we might desire to engage. The heading which was in large type read "Do you want to do your bit" and at the very end in equally large type, were the words "Or are you a quitter"? In between was the frank admission that the work was dangerous, and the statement that so far, we hadnot lost a man.

There was a brief reference to the fact that the brothers and sons were in many cases, risking their lives each and every day in the trenches in France for $30.00 a month for the protection of a bunch of fellows at home pulling down $50.00 and $60.00 a week, or more, and afraid to take a one in a hundred danger chance for the country's good.

I am sorry indeed that I have not got a copy with me of the leaflet, for it worked like a charm. After each man in the factory had come into my private room and read the thing with me I got him to sign an agreement that he would not quit the factory on less than two days' notice, and would always give to me or to the Government official his full reasons for leaving. After that was done we heard practically nothing of the effect of gas, and as a matter of fact, as far as I know, there has been no claim against the Government by any of the boys who worked at the Bound Brook plant.

I may be wholly wrong, but after a considerable experience with Phosgene (and I have nothing at all to say about Mustard Gas for I didn't work in it) it is my feeling that long before a man could inhale a sufficient dose of the gas to in any way cause permanent injury by reaction on any of the tissues or organs, the carbon monoxide heart reaction would kill.

Please understand that these are just my personal views and are not official in any way.

Yours very truly,

FH:MNJ

F. Hemingway

NATIONAL ANILINE & CHEMICAL COMPANY

Inc.
General Offices: 21 Burling Slip, New York.

February 28th, 1921.

The Chief of the
Medical Section, Chemical Warfare Service, U.S.A.,
1800 Virginia Avenue,
Washington, D. C.

Dear Sir:

In response to yours of the 16th instant, with to advise that this company did not make any liquid gas for the United States Government at its Buffalo Plant, although apparatus was being set up for the manufacture of this gas at the time the armistice was signed.

At our Marcus Hook Plant we did some work on tear gas but we are unable to tell what effects it had on our employees.

For this reason we are sorry indeed that we are not able to comply with your request of the 16th.

Very truly yours,

NATIONAL ANILINE & CHEMICAL CO., INC.

BY:
(Signed) Chas. F. Weber,
Vice President,
Manufacturing.

CFW.RS

VIEWS OF SOME OF OUR ALLIES AND OTHER EUROPEAN COUNTRIES.

Thus far in this report every effort has been made to present all available information obtained in this country. Realizing the Armies of our Allies and other European Countries were exposed to the same kinds of gases and under more extenuating circumstances, and suffered more severely from them than did our own troops, an effort was made to obtain their views.

Unfortunately the information received has been rather meager but it suffices to show that the results noted are quite similar with those reported in this country.

Views of the British on the Subject of Remote Effects of Gas Poisoning.

It must not be forgotten that the British troops received the first installment of warfare gases and suffered thousands of casualties because they were not prepared to combat the effects of the methods of warfare. As a result their first casualties were severe, in most cases getting the full effects of the gas.

The following is taken from the British Report:

There is happily every reason to think that only a very small percentage of surviving gas casualties of the war will suffer from any permanent disability. A large number of sequence of all types following gassing were functional in character, for instance, the so-called D.A.H. tachycardia, dyspnoea and pain in the chest on exertion, spasmodic cough and vomiting. For these conditions lapse of time, cessation of hostilities and treatment by graded exercises and other measures almost always effect a complete cure. In some cases, however, certain organic lesions might remain. Following the action of the lungs, irritation, the most permanent lesions were chronic bronchitis, bronchiectasis and pronounced emphysema. Mustard gas has in some of its victims left permanently damaged conditions. A substance so powerfully acting as a chemical irritant will in strong concentrations destroy tissues whether the eyes, the skin, or the respiratory tract. There is no body of evidence to determine that gassing has set up a predisposition to disease, other than tubercles, which are more probably rekindled than caused. Effects on the kidneys are rare. When a condition of asphyxia has been prolonged, the kidneys may suffer from pressure effects, but there is no proof of any action on the renal tissues.

RELATION BETWEEN TUBERCULOSIS AND GASSING.

"The relation between tuberculosis and gassing does not develop more frequently in gas victims than in other subjects, but when lesions exist they are liable to undergo rapid development. A number of gas patients having persistent cough, apical rales and even haemoptysis, gave the impression of being tuberculosis, but their sputum was found on examination to be free from albumen, and X-ray examination of the lungs showed them to be entirely clear".

From the French.

"In the majority of cases, the secondary tuberculosis seems to be simply exacerbations of an old infection which has been more or less latent.

Laryngeal irritations which occur frequently and are of long duration especially in those cases poisoned by mustard gas, will not cause disability unless they be accompanied by complete aphonia. They eye symptoms caused by mustard gas as a rule clear up completely and cause, therefore, no permanent disability.

Result of French Laboratory Experiment on Guinea Pigs.

Two lots of guinea pigs about the same weight were inoculated with a like dose of an emulsion of tubercle bacilli in physiological salt solution. One lot served as a control, the others were exposed repeatedly to a moderate dose of phosgene 0.5 ccm per cubic metre during from 5 to 18 minutes every eighth day for 5 months. At the end of nine months after inoculation, 7 of the control group had died, of which 6 showed evident lesions of tuberculosis at autopsy. The 13 survivors were killed and lesions of tuberculosis were found in 7 of them. Of the group which had been exposed to gas 5 died. Four of these showed lesions of tuberculosis. Of the remaining 15, 10 showed lesions of tuberculosis at autopsy. Therefore, the animals subjected to gas poisoning showed neither more abundant lesions and no greater tendency for these lesions to localize in the lungs than did the control animals. But the lungs of the gassed animals did show alterations due to the gas, especially congestion and edema.

Judging from this experience, it does not appear that lung lesions caused by gas predispose to tuberculosis, and also that it does not increase the tendency for the tubercules to localize in the lung."

From the Germans.

"The following information was obtained through the American Mission in Germany relative to this subject.

There is very little to be found in the German Medical Literature with reference to the late effects of gas poisoning. Whether this is due to the fact that the German Internists and pathologists have neglected to report on such cases or whether it is due to the small number of such cases occurring among the German soldiers cannot be absolutely determined. Perhaps the extreme difficulty in obtaining a pension from the Government may limit to a minimum the number of remote effects of gas poisoning sustained during the war. The best available authority in Germany, the pathologists for the Kaiser-Wilhelm Akadamey, who have made a special study of the gas poisoning states that they believed from their own personal experience and from a review of the literature on the subject that there have been very few disturbances resulting from the remote effects of gas poisoning. Those that have occurred almost invariably pertain to the respiratory system.

From a medical officer of the United States Army who made a personal investigation of this subject in Germany.

"During my conversations with German physicians, both those who are in the service at the present time and those who were in the service during the war and who are now engaged in private practice or Government work, I found that they were practically unanimous in agreeing that there were no late effects from gas poisoning. Those individuals subjected to toxic poison either died or recovered after a period of convalescence more or less protracted. Those subjected to irritant gases recovered; perhaps might have a bronchitis or other irritation of the respiratory tract for a few months and then recovered.

They state that they believe gas poisoning has no connection with tuberculosis."

From the Swiss.

"Professor Stachlin of Switzerland searched through all the chronic diseases occurring among prisoners of war interned in Switzerland and with but few exceptions could he find any suffering from the results or effects of gas poisoning. He further states: 'In making a diagnosis of the late effects of gas poisoning, the question always arises whether emphysema bronchiectasis or other disease is really the result of gas poisoning. This

can only be determined from information that the patient was well before the gas poisoning and that from the time of gas poisoning up to the present symptoms, an uninterrupted connection exists. Very frequently this information is not obtainable. Many patients are not to be trusted, especially if they have motives or former injury. Symptoms referable to other organs usually do not give any help since they are as a rule absent and if present, not typical.

Effect of Warfare Gases in Poland.

During the war over two million men from Poland took part in the great war. Due to the fact that the country was split as a result of the wars of 150 years ago, when Germany, Austria, and Russia assumed control, these men fought with the armies representing those countries. The Poles of the western section fighting with the Germans, those of the eastern and northeastern sections with the Russians and those of the south fighting with the Austrians.

Besides there was a complete Division of American Poles who fought under the command of General Haller and were affiliated with the French, their activites being confined to the western front, until the spring of 1919 when the Division was transferred to Poland.

In view of the fact that these troops were fighting in zones in which the heaviest gas attacks took place, naturally they were exposed to the fumes of this method of warfare and suffered a large number of casualties.

During 18 months, from August 1919 to December 1920, I was in command of the American Typhus Fever Expedition operating in Poland and a member of the Ministry of Public Health of Poland. In this capacity I was in a position to be thoroughly familiar with the health conditions of the country. I saw many men who had been gassed and heard of many gas engagements but never heard of any cases of disability from the effects of these attacks.

CONCLUSION

It is believed too early to arrive at final conclusions concerning the after effects of warfare gases and their association with the many diseases from which so many ex-soldiers are now suffering. From the evidence thus far obtained, however, it seems to be the concensus of opinion of medical men in not only this country but also in Europe that there is no reason to expect a greater percentage of disability cases following gas poisoning than from any of

the acute respiratory diseases of ordinary type.

It is quite apparent, however, that reliable and conclusive information concerning the true effects of war gases on latent diseases and their ability to produce permanent disability is lacking. This can only be acquired by the continued collection of clinical and pathological data.

There is no doubt permanent changes do occur in some of the more severely gassed individuals which is borne out by the alterations in the trachea and large bronchi observed at times which together with the extensive interstitial and vesicular infiltration seen in some of these cases, must naturally create disturbed pulmonary function if not causing permanent damage to it.

Since the vast majority of our gas casualties were due to mustard gas, it seems within the realms of possibility that a few cases might be encountered showing typical regeneration of the epithelium in the upper respiratory tract, peribronchial fibrosis, interstitial fibrosis, chronic bronchiectasis, aphonia, poor vision, emphysema, etc.

It is possible that cases which were severely gassed and in which severe infections took place, are open to the various sequelae that may follow any of the acute respiratory diseases.

As to the incidence of pulmonary tuberculosis resulting from the exposure to poison gases, it is far from convincing that gas played a very conspicuous role in this connection, and it is doubtful if the incidence of this disease among ex-soldiers is really greater by reason of the part that gas played in warfare.

Gas might, in some cases, be rated as a contributory cause along with camp life, exposure, military stress and other known factors causing a lowering of vitality, but I am inclined to relegate it to a rather minor role especially in the causation of tuberculosis among army men.

It is a fact that tuberculosis among service men who were exposed to gas warfare is not any greater than among men in the Navy and those who remained at home. To bear out this statement, reference is made to the report of Dr. James A. Miller, in which there seems clear evidence that tuberculosis has not increased in the armies of the world as a result of the war, but on the contrary, if

anything, it has decreased.

Those who apply for compensation a year after discharge claiming to have developed tuberculosis as a result of their army service certainly have no basis for such an assertion. They probably would have become tubercular patients even if they had never been in the army. If a year or so elapses from the time of the alleged gassing until symptoms of tuberculosis develop, it is quite probable that gas had nothing to do with the question provided that the soldier's lungs were clear at the time of discharge.

In conducting this investigation several facts have become apparent.

First. That Neuresthenia has played a most important part; as a result, many men who were really gassed, although very slightly, sincerely believe that this factor is the cause of their illness.

Second. That a large number of individuals were undoubtedly sub-standard in the beginning and would quite probably have broken down under any stress or strain.

Third. That the generally unknown effect of warfare gases has furnished many individuals a peg upon which to hang all manner of symptoms.

Fourth. That the period of time between our entry into the war and the present date, has offered ample opportunity for the onset of diseases totally unassociated with war wounds or exposure.

Fifth. That a great many confuse the after effects of warfare gases with those resulting from the severe epidemic of respiratory diseases prevalent throughout the world during the gas warfare period.

H. L. GILCHRIST,
Lt. Colonel, Medical Corps, U.S.A.,
Chief, Medical Division,
Chemical Warfare Service.

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